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PROGRAM OF THE SIXTH ANNUAL SCIENTIFIC MEETING OF THE GERONTOLOGICAL SOCIETY, INC. AND ABSTRACTS OF PAPERS TO BE PRESENTED

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THE JOURNAL OF GERONTOLOGY is a quarterly magazine published at 10 N. Howard St., Baltimore 1, Maryland, and is owned and controlled by the Gerontological Society, Inc., New York, with editorial offices at 660 South Kingshighway Blvd., St. Louis 10, Missouri. It publishes original manuscripts dealing with or bearing on the problems of aging from the fields of natural and social sciences and the humanities, review articles, and selected abstracts from current literature appropriate to the subject. Preference will be given to manuscripts containing observational data.

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JOURNAL OF GERONTOLOGY

J. E. KIRK, *Editor*
N. W. SHOCK, *Assistant Editor*

Volume 8 JULY 1953 Number 3

PUBLISHED QUARTERLY BY THE GERONTOLOGICAL SOCIETY, INC.

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J. A. SAXTON, JR., G. A. SPERLING, L. L. BARNES, AND C. M. MCCAY, *Pathologic Studies of Rats Fed Different Amounts of Fluid Throughout Life*

Dr. Saxton is assistant professor of pathology, Washington University School of Medicine, and laboratory director of the St. Louis City Hospital Division. For a number of years he has collaborated with Dr. McCay, professor of nutrition at Cornell University, and his research associates, making pathologic examinations of animals used in longevity studies.

In this experiment rats were used to determine the influence of different levels of fluid ingestion, including coffee, milk, sucrose solution, and water throughout life on the life span. Ingestion of high levels of fluid and of coffee did not appreciably alter the life span or the expected pattern of chronic diseases of old rats. A diet of milk alone, which seemed to cause increased absorption of calcium as evidenced by better teeth and bones, intensified the deposition of calcium in the kidneys of old rats. This liquid diet also led to the formation of hair balls in the stomach. Possible applications of these results to human senescence and to the comparative pathology of senescence are suggested.

C. H. LIU AND C. M. MCCAY, *Studies of Calcium Metabolism in Dogs*

Dr. Liu carried out the study reported in the Nutrition Laboratory of Cornell University under the direction of Dr. C. M. McCay, professor of animal nutrition. Dr. Liu is now a member of the staff of the Medical Research Institute of Henry Ford Hospital in Detroit, Michigan.

Using the metabolic balance technique, it was found that young puppies retained calcium more effectively than dogs aged 6 to 15 years. The old dogs were unable to maintain calcium equilibrium unless the diet was very rich in this element. When large amounts of fat were included in the diet, the old dogs tended to lose more calcium than did the puppies. The nature of the fat in the diet did not seem to alter the extent of the calcium loss in the old dogs. In the old dogs, exercise seemed to have a favorable influence on the retention of calcium.

M. D. BOGDONOFF, N. W. SHOCK, AND M. P. NICHOLS, *Calcium, Phosphorus, and Potassium Balance Studies in the Aged Male*

Dr. Bogdonoff and Miss Nichols are members of the staff of the U. S. Public Health Service and Baltimore City Hospitals Section on Gerontology of which Dr. Shock is chief.

Using the metabolic balance technique, it was found that when positive nitrogen balance is maintained by a high protein diet, calcium balance can be maintained in aged males when approximately 850 mg. of calcium per day are ingested. This level of intake is no greater than the requirement for young adults. Furthermore, increasing the calcium in the diet increased the daily retention in normal aged subjects. At high protein intakes (90 Gm. protein per day) the aged subjects were able to store nitrogen and from the relationship between the phosphorus, potassium, and nitrogen retentions it is presumed that they were able to build protoplasm.

P. G. ACKERMANN AND G. TORO, *Calcium and Phosphorus Balance in Elderly Men*

Dr. Ackermann is research assistant and Mr. Toro is research technician in the Division of Gerontology, Washington University School of Medicine.

Calcium and phosphorus balance studies were carried out in 8 elderly men who were in positive nitrogen balance. The study showed that an average of 18.5 mg. of calcium per kilogram were required daily to maintain calcium equilibrium. This figure is considerably higher than the necessary calcium intake reported in the literature for young adults. In contrast to the increased need of old individuals for calcium the amount of phosphorus required for balance was found to be of the same order of magnitude as in young persons, namely 18.7 mg. per kilogram per day.

J. E. KIRK AND M. CHIEFFI, *Vitamin Studies in Middle-Aged and Old Individuals. XI. The Concentration of Total Ascorbic Acid in Whole Blood*

Dr. Kirk is director of research and Dr. Chieffi is research assistant in the Division of Gerontology, Washington University School of Medicine.

The concentration of total ascorbic acid in whole blood was determined in 142 men and women between the ages of 40 and 103 years, who were inmates or patients in an Infirmary. The results showed a tendency for the ascorbic acid blood concentration to decrease with advancing age. This trend was more marked in the men than in the women. The findings are discussed in the light of other surveys of the ascorbic acid blood values of larger population groups.

J. E. Kirk and M. Chieffi, *Vitamin Studies in Middle-Aged and Old Individuals. XII. Hypovitaminemia C. Effect of Ascorbic Acid Administration on the Blood Ascorbic Acid Concentration*

The effect of oral administration of 100 mg. of ascorbic acid daily on the blood ascorbic acid concentration was studied in 19 middle-aged and old subjects with hypovitaminemia C. The administration in 16 of the 19 subjects caused an increase of the blood ascorbic acid content from a mean value of 0.26 mg. per cent to 1.15 mg. per cent. In the remaining 3 individuals no definite increase in blood ascorbic acid was noted, but all 3 subjects responded to subcutaneous administration of the vitamin with an increase of the blood ascorbic acid level to between 1.27 and 1.57 mg. per cent. The theoretical and practical importance of the findings are discussed.

K. Iversen, Aa. Videbæk, and J. E. Kirk, *Casual Skin Lipid Levels in Individuals of Various Ages*

At the time this study was carried out Dr. Iversen and Dr. Videbæk were research assistants in the Division of Gerontology, Washington University School of Medicine, of which Dr. Kirk is research director.

Determinations were made of the lipid levels present on the skin of the forehead and on the hands in 144 subjects, ranging in age between 13 and 90 years. The studies were conducted both during the summer and winter seasons. The mean lipid value observed on the forehead was 0.239 mg. per square centimeter in the men and 0.206 mg. per square centimeter in the women. The corresponding lipid levels on the back of the hand were 0.072 and 0.080 mg. per square centimeter. No significant correlation was noted between age and lipid levels on the forehead. The lipid concentration on the back of the hand in young women was higher than in young men and in middle-aged and old women, probably reflecting a more widespread use of hand creams by young women.

W. H. Lewis, Jr., *Differences in the Rate and Trend of Mortality for Different Age and Sex Groups in Different Eras*

Dr. Lewis occupies several staff positions with hospitals in New York City and vicinity and is in the active practice of internal medicine.

An analysis of data from U. S. Life Tables, Bureau of the Census, on the mortality of white males and females in different eras of 1890, 1900, 1910, 1920, 1930, 1940, and 1949 shows continuous improvement in survival in younger and older age groups. The specific data are summarized and presented graphically. In the periods of 1940 and 1949, the mortality shows a significant decrease in the older age groups, except for white males aged 50 to 65 years. Throughout the periods from 1890 to 1949, a significant and constant finding is the higher survival rate of females at all ages. After age 50, this difference is of major degree.

C. L. Krag, *The Prevalence of Diabetes Mellitus Among the Aged Tested in a Community Diabetes Program*

Dr. Krag is a medical officer with the U. S. Public Health Service and at present is Chief of the Hygiene of Aging Program, Division of Chronic Disease and Tuberculosis. From 1951 to 1952, he was the Officer-in-Charge of the Dallas Diabetes Demonstration Unit.

This article presents data regarding the age distribution of people with diabetes mellitus who were tested in a program which was carried out by a number of local citizens and the local health department with the assistance of the U. S. Public Health Service. The results indicated that the prevalence of diabetes increases markedly with age. It is suggested that programs related to the health of the aged should include a consideration of the high prevalence of diabetes. It was also pointed out that when the results of casefinding programs are reported, the data pertaining to casefinding rates will be of greater value if presented for uniform age groups.

K. Stern, J. M. Smith, and M. Frank, *Mechanisms of Transference and Counter-Transference in Psychotherapeutic and Social Work with the Aged*

Dr. Stern, at the time when this study was made, was chief of the Gerontological Unit in the Department of Psychiatry at McGill University. He is now professor of psychiatry at the University of Ottawa. Miss Smith was social worker within the Family Welfare Association in Montreal. Mrs. Frank who had received her training in analytic psychology in Europe, is an M.A. in philosophy at McGill University and was research assistant in the Gerontological Unit where she has been working on Counselling of Older People for the past four years.

The present study is concerned with transference mechanisms which arise during psychotherapy and counselling of old people. In spite of the fact that the physician, psychologist, or social worker is often considerably younger than the client, he represents in most cases a parental figure to the latter. There are important mechanisms of negative counter-transference. Those who work with the aged may become disturbed; either they are identifying with an indigent old person (their anxiety about their own future insecurity becomes activated), or they identify

the client with a parental figure of their own, or they feel frustrated by a lack of therapeutic gratification. These mechanisms of counter-transference are unconscious, and those who work with old people are greatly helped by being instructed along these lines.

J. H. Britton, *The Personal Adjustment of Retired School Teachers*

Joseph H. Britton received his M.A. and Ph.D. degrees at the University of Chicago, and in 1949 as assistant professor of psychology at the Pennsylvania State College he helped to organize the Committee for Study of Adulthood, of which he is chairman. Now associate professor in the Department of Child Development and Family Relationships, he is in charge of that department's research program, part of which concerns adjustments within families of older people.

This article reports the findings of replies received from 120 men and 373 women teachers who were retired compulsorily at 65 from an urban school system. While considerable attention is paid to the question of the representativeness of the study population, the major purpose of the study was to determine important areas of behavior that are associated with good adjustment in the later years.

K. Brodman, A. J. Erdmann, Jr., I. Lorge, and H. G. Wolff, *The Cornell Medical Index-Health Questionnaire. VI. The Relation of Patients' Complaints to Age, Sex, Race, and Education*

Dr. Brodman is a practicing psychiatrist and assistant professor of clinical medicine at Cornell University Medical College. Dr. Erdmann is a practicing internist and instructor of medicine at Cornell University Medical College. Dr. Lorge is the executive officer of the Institute of Psychological Research at Teachers College, Columbia University, and Dr. Wolff is professor of medicine (neurology) at Cornell University Medical College.

Data collected with the Cornell Medical Index-Health Questionnaire from 5,119 adult New York Hospital out-patients reveal that older men and women made more body complaints than younger, but a like number of complaints of moods and feelings. Women had more complaints about their bodies and about moods and feelings than did men, although both had the same average number of diagnosed disorders. Negroes had only few more complaints than did whites of the same sex. Length of schooling was not related to the number of complaints. The data indicate that medical complaints need evaluation in terms of the patient's age and sex as well as of organic and psychologic disorders.

A. I. Goldfarb, *Recommendations for Psychiatric Care in a Home for the Aged*

As chief neuropsychiatrist in the Home for Aged and Infirm Hebrews of New York, Dr. Goldfarb, a practicing neuropsychiatrist and psychoanalyst, has been faced with the problems of institution, community, resident, and staff interactions as they affect the total care of aged persons. He views an old age home as a mass psychotherapeutic program in which the staff members are psychotherapeutic instruments. The efficiency and facilities of the Home are as much a factor in the selection and maintenance of residents as is the status of the resident. For optimal service to the residents and the community psychiatric help is essential. This includes staff orientation along psychiatric lines toward an understanding of disordered behavior as meaningful adaptational efforts, and development of brief effective modes of therapy and infirmary space for those with transient severe psychiatric disorders. Several psychiatrists on a part time basis and auxiliary psychiatric personnel are required for the staff conferences and the diagnostic and therapeutic sessions.

M. B. Visscher, *Some Problems of Experimental Design in Studies of Aging*

Dr. Visscher is professor of physiology at the University of Minnesota and has studied life-span problems in mice for fifteen years.

This note stresses the importance of distinguishing between optimal and maximal rates of growth. It stresses the point that maximal growth rates need not imply optimal whole-life conditions. It points up the importance of considering causes of death in interpreting animal life span and also the crucial significance to the latter of small changes in housing conditions. Finally, the difficulty in harmonizing "controlled conditions" with similarity to natural dietary habits is discussed.

F. Herzberg, *Training in the Dental Aspects of Gerontology*

Dr. Herzberg is a practicing dentist in Beverly Hills, California, and was formerly on the staff of the Dental School of the University of Illinois.

The author reviews the catalogues of the 42 dental schools in the United States, with particular attention to their courses of instruction. He finds that 7 courses of instruction, each at a different school, make some reference to gerontology. Of these, 4 make reference to gerodontology, and one uses the word "geriatrics." Each of the 7 references is in a different course of instruction. It is concluded that in so far as the catalogues of the schools reveal interest in given subjects, the dental schools have not yet recognized the importance of the problems of aging in the training given the dental student. The author recognizes that the limits of interest of a dental school in a particular subject may not be adequately reflected in the course of instruction listed in its catalogue, but believes that the listings are indicative of general trends.

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JOURNAL OF GERONTOLOGY

VOLUME 8 JULY, 1953 NUMBER 3

Pathologic Studies of Rats Fed Different Amounts of Fluid Throughout Life

J. A. SAXTON, JR., GLADYS A. SPERLING, LEROY L. BARNES, AND C. M. McCAY

THIS report concerns the pathologic changes in rats of an experiment conducted by McCay and associates to determine the effects of widely different levels of fluid intake upon growth, body size, bone composition, teeth, diseases of old age, and the life span. Techniques of study and certain results have been reported in detail (2) and will be summarized here only as they relate to the pathologic studies.

TECHNIQUES OF STUDY AND RESULTS (RECAPITULATION)

A total of 232 young albino rats of the Yale strain 25 to 64 days old, weighing from 50 to 190 gm., equal numbers of both sexes, were divided into 4 groups (29 or 30 of each sex in each group) and given the following 4 diets, which were designed to cause different fluid intakes:

1. Cow's milk, with trace minerals, only; plus cod liver oil twice a week. No solid food was given.
2. Sucrose solution (10 per cent) as sole source of fluid, with G.L.F. open formula dog meal (2) to eat.
3. Coffee, in beverage form, as sole source of fluid, with dog meal and dry sugar supplement.
4. Water, with dog meal and dry sugar supplement (control).

The group receiving sucrose solution was allowed to set the level for sugar ingestion, and the sugar supplements given the coffee and water groups were adjusted to the same caloric value. Thus these 3 groups (excluding the milk group) had essentially the same diet, but with differences in fluid intake induced by coffee or sucrose solution. The rats were individually caged and kept in an air-conditioned room. Food and liquid intakes and calcium excretion were measured for periods throughout the animals' lives. At death autopsies were performed and the soft tissues x-rayed. The teeth (lower molars) were examined by C. A. H. Smith, and some bones were analyzed for density and calcium content.

As reported (2), the growth for all groups was similar and there were no differences in the total span of life according to diet or fluid intake. Skeletal size likewise was similar in all groups, although milk tended to keep rats at the lowest level of body weight, whereas the sucrose solution kept them at the highest. Coffee fed throughout life seemed to exercise no unfavorable effect and apparently did not produce diuresis, as evidenced by a normal fluid intake. Fluid consumption was greatest in the milk fed group, being 4 to 5 times greater than that of the water and coffee groups. The fluid intake of rats given sucrose to drink was roughly 3 times that of the water and coffee groups, presumably because of the diuretic effect of sucrose. Females had a slightly higher intake of fluid than males per unit of body weight in all groups at comparable ages.

Of particular interest was the observation that a much higher percentage of calcium was excreted in the urine of rats fed milk than in the other groups, although the milk diet allowed

Published on a grant from the Forest Park Foundation.

the lowest daily ingestion of calcium. The teeth of rats fed milk remained in excellent condition throughout life, in contrast to a high incidence of decay in the other groups. Moreover, the bones of the milk fed rats remained the most dense and contained the most calcium per unit volume at the time of death. The sucrose group had a slightly elevated urinary excretion of calcium, but no significant difference in the condition of the bones from that of the water and coffee groups was observed. Calcium deposits in the kidneys, as determined by x-ray photographs of the organs, increased in frequency with advancing age, were more common in females than in males of all groups, and had the highest combined incidence in the group fed milk. Calcium deposits in the heart and testes also increased in incidence with advancing age without relation to dietary group.

Pathologic Findings

Material for gross pathologic study was available from all but 2 rats, and for microscopic study in 166, or 72 per cent of the experimental animals. Gross examination was as complete as the condition of the tissues permitted and usually included not only thoracic and abdominal viscera but also the cranial cavity and middle ears. Microscopic examination varied in extent according to gross findings and conditions of the organs, but always included the kidneys. Tissues were fixed in Zenker's Solution or 10 per cent formalin, embedded in paraffin, sectioned at 6 μ, and stained with Hematoxylin and Eosin.

The distribution of the 66 rats not examined microscopically was toward the younger age groups and in about the same proportions in each group and sex. Tumors noted grossly were verified microscopically; but it is probable that many small tumors, especially of the pituitary, were overlooked, since routine sections of this organ were not made. However, for comparative purposes within the experiment, the pathologic data should be representative, and the incidence of recognized lesions should be in proportion to their true frequency. The testes, especially of older animals, were examined microscopically to determine the presence or absence of spermatogenesis. Ovaries were rarely sectioned, but usually appeared functional at autopsy.

For purposes of tabulation, rats of each sex in each group were divided according to age into 200 day periods (0-200, 201-400, 401-600, 601-800, and 801-1000). It is perhaps noteworthy that no male rat exceeded the age of 796 days, and that the oldest female reached the age of 961 days. In a former experiment (3), in which 200 controls received an ad libitum diet, 7 of 100 females lived over 1000 days. The conditions of this experiment would thus seem to be less favorable to a long life span than those of the controls in the experiment cited. Nevertheless, in few instances the probable cause of death was not apparent.

It should be stated at the outset that the principal diseases found were the same as in earlier experiments (3, 6) and that these differ markedly from the major diseases of old age in humans. It should also be pointed out that, as many of these disorders are apparently chronic and progressive, the degree of involvement or impairment of the organ concerned is more important than the mere presence or absence of the disease. This is of course true in humans, especially in the case of arteriosclerosis, where the beginnings may be seen in the early decades of life but serious interference with function does not ordinarily take place until later life.

The major disease of rats in this strain, pneumonia with bronchiectasis, would seem to be inflammatory rather than degenerative and hence may not be easily accepted as analogous to diseases of old age in man. However, other studies (6) have shown it to be chronic and progressive, increasing in incidence and severity with age. Changes with age have been shown in the rat lung which would favor development of the condition in advanced age (7). The lung in the rat may perhaps be compared with the vascular system of man as the major factor limiting the life span. In view of their quantitative features, certain diseases

such as chronic pneumonia, chronic nephrosis, and calcium deposits in the kidneys are recorded in the tables of incidence only when present in what was regarded as a significant degree.

The following tabulations of common diseases more or less in order of frequency show the relations of the dietary variables to their incidence. Since the variables did not seriously alter the average life span of any group, it seems unlikely that the differences observed are related to differences in the ages of the animals. They can therefore be correlated directly to the conditions of the experiment.

Chronic Pneumonia: As shown in table 1, chronic pneumonia with bronchiectasis occurred in high incidence in all groups and was apparently not influenced by the experimental regimens. It seemed to be the major cause of death in most animals, irrespective of age. The tabulation includes only those examples which involved a significant amount of lung tissue.

TABLE 1. CHRONIC PNEUMONIA IN RATS: FREQUENCY IN RELATION TO DIETARY GROUP AND AGE.

Group	Sex	Examined (N)	Chronic Pneumonia (N)	Frequency (Per Cent)
Dietary:				
Water	M	29	25	86.2
	F	28	25	89.2
Milk	M	25	23	92.0
	F	28	25	89.2
Sugar	M	29	26	89.6
	F	28	23	82.1
Coffee	M	28	19	68.0
	F	28	23	82.1
Age (days)				
201- 400	M & F	27	22	81.4
401- 600	M & F	101	87	86.1
601- 800	M & F	75	65	86.6
801-1000	F	20	15	75.0

Middle Ear Disease: Middle ear suppuration, a common finding in many strains of rat, is difficult to relate to aging and may represent a colony infection which increases with prolonged exposure. It has no quantitative aspect, being present or absent in one or both ears. Ordinarily there are no associated signs, but rarely it caused brain infection. There was an increase in incidence with advancing age, and the condition was least common in the coffee group, as shown in table 2.

TABLE 2. MIDDLE EAR DISEASE IN RATS: FREQUENCY IN RELATION TO DIETARY GROUP AND AGE.

Group	Sex	Examined (N)	Middle Ear Disease (N)	Frequency (Per Cent)
Dietary:				
Water	M	27	16	59.0
	F	28	21	75.0
Milk	M	21	17	81.0
	F	24	21	87.5
Sugar	M	27	23	85.1
	F	24	18	75.0
Coffee	M	28	13	46.4
	F	27	18	66.6
Age (days)				
201- 400	M & F	24	11	45.8
401- 600	M & F	91	66	72.5
601- 800	M & F	73	54	74.0
801-1000	F	18	16	88.8

Chronic Nephrosis: Chronic nephrosis, characterized by formation of albuminous casts in tubules with obstruction of nephrons and without inflammation, has been found in all former experiments (3, 6). It was increased in frequency and severity in groups of animals receiving high protein diets, and the incidence rose with advancing age. It seems to be related to the concentration of protein in the urine. In this experiment, as in others, it was more common in males than females at corresponding ages. As shown in table 3, it was more common in males than females in each experimental group and had its least incidence in animals fed milk.

Renal Calcium Deposits: Calcium deposits

TABLE 3. CHRONIC NEPHROSIS IN RATS: FREQUENCY IN RELATION TO DIETARY GROUP AND AGE.

Group	Sex	Examined (N)	Chronic Nephrosis (N)	Frequency (Per Cent)
Dietary:				
Water	M	20	10	50.0
	F	21	3	14.3
Milk	M	20	7	35.0
	F	19	2	10.5
Sugar	M	22	11	50.0
	F	21	7	33.3
Coffee	M	19	8	42.1
	F	23	9	39.1
Age (days)				
201-400	M & F	12	1	8.3
401-600	M & F	71	15	21.1
601-800	M & F	63	29	46.8
801-961	F	19	12	63.1

were noted in the kidneys in conspicuous or significant degree in 44.2 per cent of rats. Females were affected more often than males, the frequencies being 66.6 per cent and 21.0 per cent respectively. There were two types of deposit, as shown in figures 1 to 4, in the corticomedullary zone and in the angle of the calyx. The two types of deposit occured separately or together. The deposits in the corticomedullary zone were more common, and the sex difference was greatest in these deposits. Except in a very few instances where renal stones obstructed the urinary bladder it was difficult to assess the damage produced by deposits. The condition seemed unrelated to chronic nephrosis. As shown in table 4, calcium deposits were greatest in the milk group, where chronic nephrosis was least, and were lowest in the water or control group.

When the two types were separated and tabulated by total incidence, as shown in table 5, it was evident that the high incidence of calcification in rats given milk was largely due to an increase in deposits in the angle of the calyx.

It is not possible to account for all of the

TABLE 4. RENAL CALCIUM DEPOSITS IN RATS: FREQUENCY OF ALL SIGNIFICANT DEPOSITS IN RELATION TO EXPERIMENTAL GROUP AND AGE.

Group	Sex	Examined (N)	Renal Calcium Deposits (N)	Frequency (Per Cent)
Dietary:				
Water	M	20	1	5.0
	F	21	15	71.4
Milk	M	20	7	35.0
	F	19	14	73.7
Sugar	M	22	7	31.8
	F	21	10	47.6
Coffee	M	19	3	15.8
	F	23	17	73.8
Age (days)				
201- 400	M & F	12	2	16.6
401- 600	M & F	71	29	40.8
601- 800	M & F	63	29	46.0
801-1000	F	19	13	68.4

TABLE 5. RENAL CALCIUM DEPOSITS IN RATS: TOTAL FREQUENCY ACCORDING TO LOCATION, BY GROUP, SEX AND AGE.

Group	Sex	Cortico-Medullary Zone (Per Cent)	Angle of the Calyx (Per Cent)
Dietary:			
Water	M	0.0	5.0
	F	81.0	4.8
Milk	M	35.0	65.0
	F	58.0	79.0
Sugar	M	36.3	18.1
	F	71.4	23.8
Coffee	M	42.1	21.0
	F	74.0	17.4
Age (days)			
201- 400	M & F	16.6	0.0
401- 600	M & F	47.9	23.9
601- 800	M & F	55.5	31.7
801-1000	F	63.2	42.1

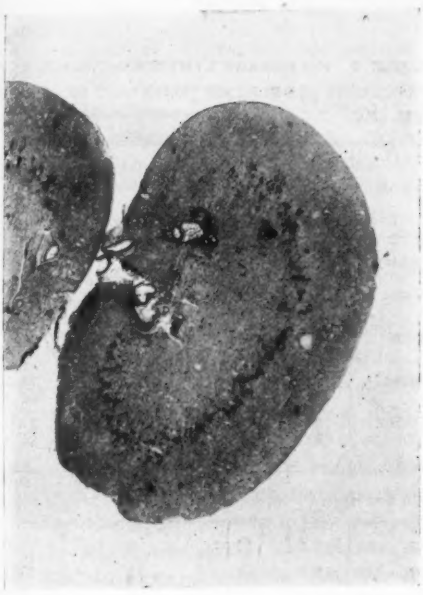

FIG. 1. Low power photomicrograph of kidney showing calcium deposits in the cortico-medullary zone. H & E stain, 5x.

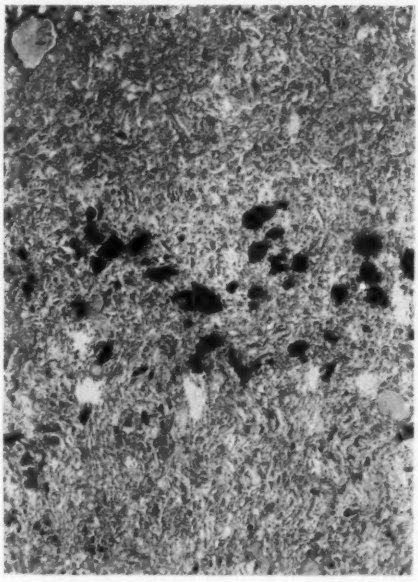

FIG. 2. Medium power view of calcium deposits in kidney of fig. 1. This rat also had a moderate degree of chronic nephrosis, as evidenced by the casts in collecting tubules and dilatation of glomerular spaces. H & E stain, 40x.

FIG. 3. Low power photomicrograph of kidney from milk fed rat, showing calcium concretions at the angle of the calyx. H & E stain, 5x.

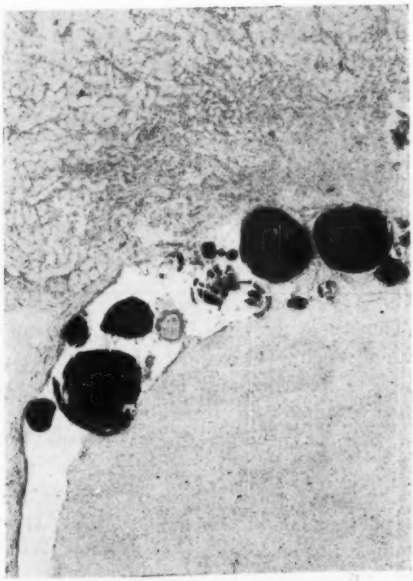

FIG. 4. Medium power view of calcium concretions in kidney of fig. 3. Note the laminated structure of the deposits and their apparent extrusion into the calyx. There is slight papillary proliferation of the mucosa. H & E stain, 40x.

variations from group to group. It is probable that these deposits occur in relation to the amount of calcium assimilated from the diets, which in excretion becomes precipitated in different parts of the kidney during concentration and depending upon the amount present.

Tumors: A total of 91 primary tumors occurred in 73 of 225 rats examined. There were 14 examples of double primary tumors and two instances of triple primary growths. The distribution of tumors (rather than tumor bearing animals) according to dietary group, sex, and age is shown in table 6.

TABLE 6. TOTAL TUMORS (MALIGNANT AND BENIGN) IN RATS: FREQUENCY IN RELATION TO DIETARY GROUP, SEX AND AGE.

Group	Sex	Examined (N)	Tumors (N)	Frequency (Per Cent)
Dietary:				
Water	M	29	13	44.8
	F	28	11	39.2
Milk	M	25	11	44.0
	F	29	6	20.6
Sugar	M	29	12	41.4
	F	28	13	46.4
Coffee	M	29	11	37.9
	F	28	14	50.0
Age (days)				
201- 400	M & F	28	1	3.6
401- 600	M & F	102	22	21.6
601- 800	M & F	75	54	72.0
801-1000	F	20	14	70.0

Tumors of all types increased in frequency with advancing age and occurred in about equal numbers in males and females. There were fewer examples in female rats on the milk diet than in the other groups, irrespective of sex.

The tumor most commonly present was a lymphosarcoma of the lung. There were 49 examples, or an incidence of 21.8 per cent. The distribution according to group, sex and age is shown in table 7.

It is apparent that the low observed frequency of this tumor in female rats fed milk accounted for the low incidence of total tumors in this sub-group. No explanation is evident. This tumor has been a common finding in rats of the Yale strain and its general incidence in this experiment is comparable to that in control rats of a former experiment (8). It was first described by Bullock and Curtis in 1930 (1), and Moon and associates (5) have observed the same tumor in rats following treatment with pituitary growth hormone.

TABLE 7. PULMONARY LYMPHOSARCOMA IN RATS: FREQUENCY IN RELATION TO DIETARY GROUP, SEX AND AGE.

Group	Sex	Examined (N)	Pulmonary Lymphosarcoma (N)	Frequency (Per Cent)
Dietary:				
Water	M	29	8	27.6
	F	28	8	28.6
Milk	M	25	7	28.0
	F	29	2	6.9
Sugar	M	29	7	24.1
	F	28	6	21.4
Coffee	M	29	5	17.2
	F	28	6	21.4
Age (days)				
201- 400	M & F	28	0	0
401- 600	M & F	102	16	15.7
601- 800	M & F	75	28	37.3
801-1000	F	20	5	25.0

Chromophobe adenoma of the anterior pituitary gland, the most common benign tumor in this strain (8), was found in 28 rats, or 12.8 per cent. There were 17 examples in males and 11 in females. No relation to dietary groups was found.

Of the 14 remaining tumors, there were 2 examples of leukemia, 2 mammary fibroadenomas, 2 fibromas of the leg, 2 papillomas of the renal pelvis, 1 adenoma of the lung, a squamous papilloma of the forestomach, a fibroma and a myelolipoma of the kidney, a cyst of the ovary, and a lymphosarcoma arising

in the abdomen. These bore no relation to dietary group.

Gastro-intestinal Lesions: Ulcers of the stomach were found in 13 rats, an incidence of 5.8 per cent. There was no relation to dietary group. However, 5 of the ulcers, or 38.5 per cent, occurred in rats with pituitary tumors. Of the 13 ulcers, 3 had perforated, all in association with pituitary tumors. Since there were 28 rats with pituitary tumors, or 12.8 per cent, there seemed to be 3 times more than chance association of the two lesions. The ulcers examined microscopically had the characteristics of chronic peptic ulcers of humans. It seems probable that the presence of an intracranial lesion in the pituitary region altered the function of the parasympathetic centers of the diencephalon and thus favored the development of peptic ulceration. The association is well established experimentally and by observations in humans (9).

The most striking gastro-intestinal lesion was the presence of hair balls in the stomachs of 7 of 29 male rats on the milk diet and 19 of 29 females on the milk diet. In no other experimental group were hair balls found. No satisfactory explanation can be offered. Hair balls have been noted rarely in animals of other experiments or of the stock colony. Ingestion of hair during preening may be a natural process, and perhaps the milk curds or low residue favored retention of hair in masses in the stomach. On the other hand, excessive eating of hair may have been evidence of a perverted appetite due to some deficiency of this diet other than lack of solid food. The most likely explanation is that the eating of hair is caused by a craving for bulk when animals are given a purely liquid diet. If so, hair would seem to be a poor form of bulk, as its shape may be resistant to peristaltic action. An experiment in which ground cellophane was given along with a liquid diet apparently prevented the formation of hair balls (4). The rats in all instances were caged on grids without access to sawdust or litter. Hair balls did not seem to contribute directly to death. In only two instances were they associated with gastric ulcers, one perforated. This rat had also a large pituitary tumor, advanced deposits of calcium in the kidneys, obstruction of the urinary bladder by stones, and a pulmonary lymphosarcoma, as well as suppuration of one middle ear.

Vascular Lesions: The rat seems conspicuously free of vascular disease in old age in contrast to human beings. No example of arterial or arteriolar sclerosis comparable to that of humans was found in the microscopic sections of the old rats, although it must be stated that examination of the heart and vessels was not carried out thoroughly in each case. Myocardial fibrosis and intracardiac thrombi were occasionally noted, and there was no apparent relation to dietary group. Periarteritis, involving particularly the mesenteric vessels, was found in 13 rats, or 6.0 per cent, distributed among all dietary groups and both sexes. There were 10 examples in females and 3 in males, and 6 of the cases occurred in rats receiving sucrose solution. However, the numbers were too small to be regarded as significant.

Miscellaneous Lesions: Many lesions were noted infrequently and so were not tabulated. These included urinary infections and obstructions in males, pyosalpinx in females, tapeworms, and acute pneumonias. There were many examples of malocclusion of incisors, which must have interfered with nutrition. Random microscopic examination of the testes showed spermatogenesis in most animals of all groups at all ages, with no apparent tendency of any group to testicular degeneration.

Discussion

Because of differences according to species in the overall pattern of disease in old age, it is difficult to apply the observations of an experiment using rats directly to man. Nevertheless, certain general analogies and conclusions may be drawn. Sex differences are highly significant in animal experiments, and hence in human application, both as to life span and physio-pathology. The geriatrician is dealing with old men and old women, not merely with old people.

The observation that the general pattern of disease and consequently the life span was not significantly altered by the modifications of diet in this experiment is of importance in two ways. It suggests first of all that the pattern of aging within a species, and consequently the span of life, is relatively resistant to some environmental factors of diet and fluid intake. Ingestion of a human equivalent of 10 cups of coffee per day throughout life produced no recognized unusual disease in rats, nor accelerated the progress of chronic diseases peculiar to the species. While this finding may not be directly applied to man, there remains the implication of a considerable latitude in the pursuit of certain dietary habits usually regarded as detrimental to health.

Conversely these experiments indicate that more drastic modifications of diet are necessary to alter the average life span, favorably or unfavorably. Other experiments cited support this view (3). That the differences in diseases noted in relation to the dietary groups did not significantly alter the average span of life suggests that the presence of one disease may affect the development of another. Although the milk diet led to the production of hair balls in the stomach and intensified the deposition of calcium in the kidneys, the frequency of chronic nephrosis was lowest in this group. A high fluid intake thus is not necessarily harmful to the kidneys.

These data show that by a diet containing calcium in a form readily assimilated it is possible to maintain the bones in a relatively normal condition in old age. In view of the poor healing of broken bones in old age and the clinical problems of management of patients with fractured hips, it is desirable to know what diets will lead to the strongest bones, from the standpoint of preventing fractures and promotion of healing. Milk seems to be an excellent source of available calcium. The presence of lactose may facilitate absorption. It is also noteworthy that the milk diet maintained the teeth of rats in perfect condition into old age.

In regard to the comparative pathology of senescence, it is apparent from this and former experiments that rats kept under the best of laboratory conditions show a pattern of disease in old age which is perhaps characteristic of the species or strain and certainly different from that of man. The major neoplasms differ from those of man in frequency, and the other major diseases which seem to limit the life span are moreover different in kind. In spite of the differences it may be that underlying aging processes in various organs predispose to the diseases, even though some seem inflammatory rather than degenerative, as are the diseases of old age in man.

The pattern of aging may thus be constitutionally or genetically determined for each species and strain and may depend upon the structure and function of the organs involved. Diseases of aging never assume significant proportions within the reproductive span of the species; thus they lie outside the selective factors of evolution. As shown by this experiment and others, modifications of diet may within limits alter the incidence of certain spontaneous diseases of advanced age and, depending upon degree, may modify the life span. There is no evident reason why the same principles should not apply to man.

Summary

Pathologic studies were made of rats used in an experiment designed to determine the influence of different levels of fluid ingestion, including coffee, milk, sucrose solution, and water throughout life upon the life span. Ingestion of high levels of fluid and of coffee did not appreciably alter the life span or the expected pattern of chronic diseases of old rats of the Yale strain. A diet of milk alone, which led to increased urinary excretion of calcium and presumably absorption, as evidenced by better preservation of bones and teeth, intensified the deposition of calcium in the kidneys of old rats, especially in the region of the calyx. This liquid diet also led to the formation of hair balls in the stomach presumably because of lack of solids. The occur-

rence of pituitary tumors seemed to favor the development of peptic ulcers of the stomach.

The possible significance of certain results of the experiment are discussed in relation to human senescence and the comparative pathology of senescence.

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These studies were supported in part by a research grant from the U. S. Public Health Service, in part by a grant from the Office of Naval Research, and in part by a grant from the Rockefeller Foundation, all to Cornell University.

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Submitted for publication April 1, 1953

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Studies of Calcium Metabolism in Dogs

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AMONG the inorganic constituents of food and tissue, calcium has probably been given more attention than any other element during the past century. In the field of nutrition, attention has been centered principally upon the development of the skeleton in growing animals. Some consideration has been given to the maintenance of the skeleton in middle-aged adults. Almost no research has been allotted to the maintenance of the bony structure during the last third of life although the marked deterioration in the bones of old people and animals has been familiar knowledge for centuries.

The familiar trajectory type of curve applies to the bones of the body in relation to their maintenance just as it does to numerous other phenomena associated with the span of life. During the first fraction of life the bones and the body are created; during a middle period they are maintained; during the declining fraction of the span, the bones and many other parts of the body deteriorate.

Problems of calcium metabolism and the maintenance of the skeleton during the declining period of life are probably far more intricate than during the growing period because during the declining stage of life the body is beset by numerous chronic difficulties. The endocrines function differently; appetite often fails, resulting in decreased food intake; the body is often given little exercise; chronic diseases slowly encroach upon the normal functioning of many of the organs and modify equilibria within the body.

For some years (4) it has been recognized that individual animals of various species tend to go into negative calcium balance when about two-thirds through the span of life. The possibility exists that the calcium balance may afford one criterion of true physiologic age in contrast to the usual concept of age of the body in terms of months or years.

In this study of calcium balances made upon more than a hundred dogs, an attempt was made to learn more about the level of calcium, essential for both young, growing puppies and old dogs. Since calcium assimilation has long been known to be influenced by numerous other substances in foods such as phosphates, lipids, and various anions, these substances were given special attention.

All studies were made upon purebred, registered dogs whose life histories were well known. All puppies were bred and reared in our own kennel. All balances were run for 7 or 10 days after a period of preliminary feeding lasting for at least 4 days.

Aliquots for analyses were taken from fresh slurries of feces prepared in a Waring blendor. Urine samples were analyzed separately. Calcium and phosphorus determinations were made by AOAC methods except that some of those for phosphorus were run by the method of Simonsen (9).

Experiments with Growing Beagle Puppies

Since relatively little is known about the calcium-phosphorus needs of growing puppies compared to other species (1, 2, 5), 3 preliminary studies were made. In the first, the level of calcium was decreased as the beagles grew. A diet was used of the following composition in per cent: fibrin or casein 17, corn flakes 42, horse liver powder 3, brewers' yeast (0.1/8 irradiated) 8, lard 14, cod liver oil 2, mineral mixture 4, and sucrose 10. The mineral mixture had the following percentage composition: NaCl 34.9, KCl 41.5, $MgSO_4 \cdot 7H_2O$ 19.3, $FeSO_4 \cdot 5H_2O$ 4.0, NaF 0.12, $CuSO_4 \cdot 5H_2O$ 0.08, $MnSO_4$ 0.04, potassium aluminum sulfate 0.02 and KI 0.01.

The calcium level was adjusted with calcium carbonate and the phosphorus with calcium monobasic phosphate. Percentages of minerals in the diets were expressed on dry basis. These data indicate that the per cent assimilation of calcium drops between the fourteenth and twentieth week of age (table 1). At the low intake level and at 20 weeks of age 2 of the 6 puppies were in negative balance.

Published on a grant from the Forest Park Foundation.

In the second study 6 pairs of beagle pups, 8 weeks old, were used in a balance trial holding the phosphorus at a level considered adequate but varying the calcium intake through a wide range. When these pups were 12 weeks old a balance was run using a diet adequate in calcium but varying in phosphorus level.

The diet used in this study consisted of corn flakes 30 per cent, casein 10, brewers' yeast 10 (0.1/8 irradiated), lard 8, cod liver oil 3, mineral mixture 3, and sucrose 36. The balances were run on pairs of dogs rather on individuals. The results (table 2) indicate that puppies absorb progressively more calcium as the level rises, but there is a minimum level which throws them into negative balance, and the latter observation will be further proved by the results of the following experiment in

TABLE 1. DATA FOR CALCIUM BALANCES BASED UPON THE MEAN VALUES FOR 6 BEAGLE PUPS
(Only 3 Pups in Each of IVa and IVb)

Expt. No.	Age (wks.)	Body Weight (kg.)	Diet (per cent)			Intake (mg./Kg./day)		Retention (per cent)	
			Protein	Calcium	Phosphorus	Calcium	Phosphorus	Calcium	Phosphorus
I	7	2.6	Fibrin	0.87	0.40	298	138	54 ± 2*	52 ± 2*
II	9	3.1	Fibrin	0.59	0.35	208	124	72 ± 4	72 ± 3
III	14	5.1	Casein	0.14	0.43	39	121	61 ± 6	40 ± 3
IVa	20	7.8	Fibrin	0.15	0.31	30	60	23 ± 8	19 ± 6
IVb	20	8.0	Fibrin	0.15	0.73	30	145	10 ± 9	20 ± 3

*Mean ± S.D.

TABLE 2. CALCIUM AND PHOSPHORUS BALANCES OF BEAGLES AT 8 AND 12 WEEKS OF AGE.
(Values from Balances in 6 Pairs of Beagles)

Diet No.	Body Weight per Beagle (kg.)	Diet (per cent)		Intake (mg./Kg./day)		Balance (mg./Kg./day)	
		Calcium	Phosphorus	Calcium	Phosphorus	Calcium	Phosphorus
	8 Weeks Old Calcium intake varied; constant Phosphorus intake						
1	2.0	0.06	0.36	24	144	- 2	21
2	1.7	0.21	0.36	88	151	32	36
3	2.0	0.45	0.36	189	151	106	61
4	1.9	0.92	0.36	395	154	133	64
5	1.9	1.36	0.36	578	153	146	65
6	1.0	2.41	0.36	1107	165	271	79
	12 Weeks Old Phosphorus intake varied; constant Calcium intake						
7	3.3	0.56	0.38	391	268	199	110
8	3.3	0.55	0.78	394	558	245	124
9	3.1	0.57	1.48	421	1091	202	255
10	3.3	0.57	2.23	405	1589	209	416

which all the dogs were in negative calcium balance when a diet of very low calcium content was fed. This minimum is interesting because it affords a level for comparison with old dogs.

Varying the phosphorus level when the diet contained a substantial level of calcium affected the amount of phosphorus stored but did not affect the calcium.

In order to determine if there is a crucial age level in growing puppies that permits minimum body losses when animals are fed very low levels of calcium, 14 balances were run with beagles varying in age from 6 to 25 weeks.

A diet was devised that was relished by the dogs but which was very low in calcium. This diet consisted of cooked horse meat 84 per cent, lard 10, cod liver oil 3, and mineral mixture 3. In order to check diarrhea, it was found necessary to add 10 per cent by weight of tomato pomace to the mixture. Sucrose was then added to adjust the needs of the dogs to energy requirements.

The intake of calcium upon this diet varied from 4 to 8 mg/kg/day, while the losses varied from 3 to 29 mg/kg/day. The highest loss was for 2 puppies that were 6 weeks old. If these data are excluded the mean loss was 8.3 ± 2.8 mg. with a highest of 13. The phosphorus intake varied from 34 to 51 mg/kg/day while the balances ranged from −9 to 9 mg/kg/day. All dogs were in negative calcium balance while about half remained in positive phosphorus balance.

These results (fig. 1) indicate that there is a substantial difference among individual beagles in their ability to conserve body calcium and that this ability is not related to the age of the dog at least up to 6 months old. Furthermore, these data indicate that the correlation is 0.947 between the excretion of calcium under these conditions in relation to the body weight of the dog. This accords with the observations of Steggerda and Mitchell in regard to man (11).

Since earlier studies had indicated that there are substantial differences in the ability of experimental animals to utilize calcium in the presence of oxalates and that changes take

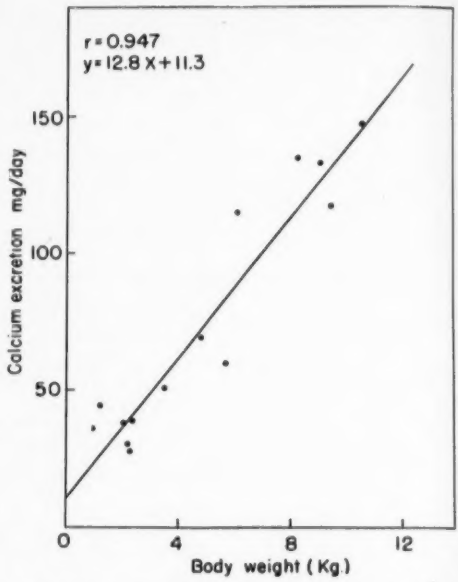

FIG. 1. The relation between calcium excretion and body weights of young dogs; very low calcium was fed.

(correlation coefficient $P < 1\%$)
(regression coefficient $P < 1\%$)

place during the growing period of the animals, it was considered worth while in the third study to investigate another insoluble form of calcium, namely, the sulfate. Earlier exploratory studies with dogs have indicated that they, like rats, show an age relationship in their ability to utilize calcium oxalate. The young seem to acquire this ability when about 2 months old and then to lose it when about two-thirds through the span of life (3).

In the present trial, balances were run upon 6 litter mate beagle puppies. These were started when the puppies were 9 weeks of age and concluded when they were 34 weeks old. A basal diet was made of cooked horse meat 55 per cent, corn flakes 10, brewers' yeast (1 per cent irradiated) 10, lard 10, cod liver oil 2, mineral mixture 3, and sucrose 10. Three of the puppies were given calcium by mixing 100 Gm. of this diet with 60 Gm. of evaporated milk. The other pups were given a supplement of calcium sulfate as a source of calcium (table

3 and 4). In the latter case dried yeast was added to equalize the diet with that supplemented by milk in terms of protein and phosphorus.

An analysis of variance (10) of the calcium retention of the 6 dogs of Experiments S1 to S4, and M1 to M4, shows that there is no significant difference between calcium sulfate and milk as the calcium sources in the diet; however the decrease of the retention with age is highly significant.

Studies with Old Dogs

Although all of the studies reported here were made with registered dogs of known age, there remained the problem of poor appetites and great individual variability that characterizes the old of all species which are usually suffering from degenerative diseases that have not been diagnosed. Special diets had to be devised for these older dogs, since such dogs will not eat many mixtures relished by growing puppies.

In this section have been summarized the results from 13 balance studies using 17 old dogs of various breeds including 5 cocker spaniels, 5 beagles, and several others of the smaller breeds. Most of the dogs were used more than once.

Two types of diets were used. The first contained casein or fibrin 20 per cent, lard 17, brewers' yeast (0.1/8 irradiated) 8, corn flakes 39, cod liver oil 2, mineral mixture 4, sucrose 10. The second contained cooked horse meat 49.2 per cent, cooked horse liver 1, fibrin 8, casein 8, lard 10, cod liver oil 3, corn flakes 10, brewers' yeast (0.1/4 irradiated) 4, wheat germ 2, mineral mixture 3.8, and sucrose 1. In experiment number 0-5 a simpler mixture was used. This consisted of cooked horse meat 84 per cent, lard 10, mineral mixture 3, and cod liver oil 3 with the addition of 10 per cent tomato pomace to the mixed feed. Dog meal was the commercial stock diet used.

The dogs were 6 to 15 years of age. The mean age was 9. The data from all of these balance studies have been assembled in table 5.

TABLE 3. COMPARISON OF CALCIUM SULFATE AND EVAPORATED MILK AS SOURCES OF CALCIUM FOR GROWING BEAGLE PUPPIES. ALL DIETS CONTAINED 0.6% PHOSPHORUS.

Expt. No.	Age (wks.)	Body Weight (kg.)	Calcium in Diet (per cent)	Intake (mg./Kg./day)		Balance (mg./Kg./day)	
				Calcium	Phosphorus	Calcium	Phosphorus
			Calcium Sulfate				
S1	9	2.2	0.2	80	221	47 ± 7*	103 ± 13*
S2	14	4.2	0.2	68	232	34 ± 10	79 ± 16
S3	19	5.5	0.2	58	182	0 ± 10	27 ± 6
S4	24	6.4	0.2	56	205	- 3 ± 7	56 ± 8
S5	29	7.7	0.35	103	170	5 ± 9	13 ± 5
S6	34	8.8	0.45	127	169	9 ± 4	20 ± 1
			Milk				
M1	9	2.2	0.2	88	202	55 ± 9	100 ± 12
M2	14	4.2	0.2	80	230	39 ± 13	82 ± 2
M3	19	5.4	0.2	60	160	12 ± 11	20 ± 4
M4	24	6.9	0.2	58	160	1 ± 8	34 ± 12
M5	29	8.5	0.35	89	144	4 ± 6	3 ± 6
M6	34	9.9	0.45	112	136	9 ± 10	8 ± 9

*Mean ± S.D.

TABLE 4. ANALYSIS OF VARIANCE.

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Source of calcium	1	247.05	247.05
Age	3	11615.46	3817.82*
Dogs within lots	4	36.33	12.11
Source of calcium x age	3	108.45	36.15
Dogs x age within source of calcium	12	1360.34	453.45
Total	23	13367.63	

These results indicate that the old animals had difficulty in most cases in maintaining their stores of calcium unless they ingested 86 mg. of calcium per Kg. of body weight per day. The needs of most older dogs would be met by an ingestion of slightly more than a hundred mg. per Kg. of body weight per day (table 5), whereas the puppies will be in calcium balance on an intake of about 25 mg. per Kg. body

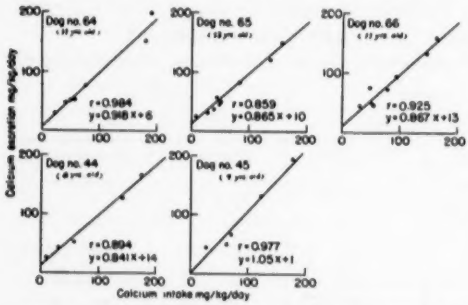

FIG. 2. The relation between calcium intake and excretion of 5 old dogs.
(All correlation coefficients $P < 1\%$, except Dog No. 44, $P < 5\%$)
(All regression coefficients $P < 1\%$)

weight daily (table 1, Experiments IVa, IVb, and table 2).

The slope of the curves for different individuals (fig. 2) suggests that the ability of the body to retain its calcium upon moderate intakes of this element might serve as one criterion of physiologic age as contrasted with chronologic age.

In figure 3, the coefficient 0.542 in the equation $y = 0.542x + 9.0$ indicates that the

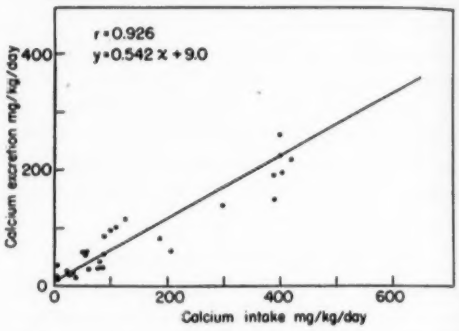

FIG. 3. The relation between calcium intake and excretion of 34 young dogs, based upon the group averages of 29 experiments.
(correlation coefficient $P < 1\%$)
(regression coefficient $P < 1\%$)

mean percentage of excretion of the dietary calcium in the experiments is 54.2 per cent of the intake. The estimated equilibrium point (when $x = y$) is 19.6 mg., which is a daily requirement on per Kg. body weight basis. The mean percentage of calcium excretion for the old dogs is 87.9 per cent of the intake (fig. 4). Thus retention is much lower than in young pups. The equilibrium point (when $x = y$) is 107 mg. per Kg. body weight per day. Hence both 19.6 and 107 mg. as estimated from the regression equations could be compared with the 25 mg. and 100 mg. suggested above.

Young puppies can use calcium much more efficiently and, as expected, retain more than older dogs. Young adult age was not included in this investigation. However, it is evident that dogs need much more calcium than human beings on the body weight basis. Steggerda and Mitchell (11) state that an intake of 10 mg/kg/day represents the mean adult requirement, while Roberts and associates (8) have studied the calcium metabolism of women from 52 to 74 years of age and found that the mean requirement for equilibrium was 14 mg. per Kg. body weight daily.

Since earlier studies with hamsters and rats had indicated that both the level and hardness

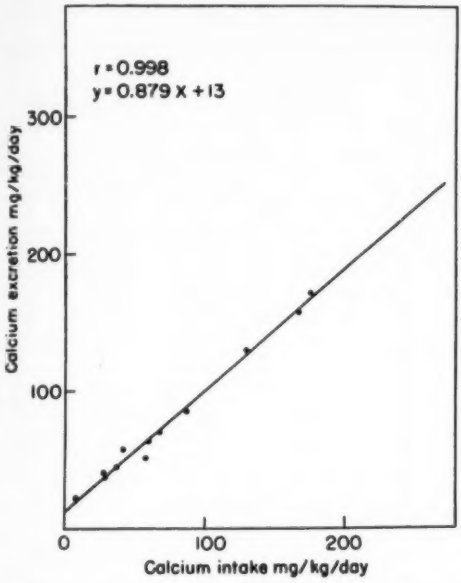

FIG. 4. The relation between calcium intake and excretion of 17 old dogs, based upon the group averages of 12 experiments.
(correlation coefficient $P < 1\%$)
(regression coefficient $P < 1\%$)

of the food fats modified the calcium balance, a series of studies were made with 6 old dogs. The same animals were used in consecutive periods of ten days each.

The diets used consisted of a mixture of corn flakes 30 per cent, casein 10, brewers' yeast 8, cod liver oil 3, and mineral mixture 4. The low fat diets contained 5 per cent fat and 40 per cent sucrose, while the high fat ones contained 40 per cent fat and 5 per cent sucrose.

The results (table 6) indicate that the level of the fat does influence the calcium balance. High levels tend to throw the animal into negative balance. Beef tallow and corn oil were used. The hardness of the fat in this group of dogs seemed to have no effect. The higher levels of fat gave more soaps as well as lipids in the excreta.

EXERCISE AND CALCIUM BALANCE

Before proceeding far in the evaluation of dietary factors in calcium balance, one must give some attention to other variables such as exercise. This is a complex problem because small breeds of dogs tend to exercise in their cages while large breeds seldom do. Furthermore, there are great individual differences among old dogs. Some are very active; others are lethargic.

Both Pinkos (7) and Peitsara (6) found in studies with dogs that exercise tended to increase the storage of calcium. In the present study an exerciser with an endless belt was used for exercising 4 dogs at a time. The speed could be varied. In the present study the gradient was set at 15 degrees and the belt speed at 2.4 kilometers per hour.

Four old dogs were used for the first 2 experiments, 1 beagle and 3 cockers over 12 years of age. During the first period, they were confined to the metabolism cage without extra exercise. During the second period, they were exercised twice daily for 20 minute periods. In the second exercise study, the beagle had to be withdrawn because of her habitual excretions in the exerciser, so only the cockers were used.

The results of these exploratory studies (table 7) indicate a trend favorable to calcium balance. This is sufficient to justify further study of this complicated field that must take account not only of the age, condition, and nutrition of the dog, but of the chronic diseases with which the animals may be afflicted.

SUMMARY

A comparison has been made between the calcium metabolism of old and young dogs. During the growing period the ability of puppies to retain calcium, when the dietary intake of this element is low, tends to be inversely proportional to the age of the pup. This same trend continues between the ages of 6 and 15 years. Old dogs have trouble maintaining equilibrium unless the diet is relatively rich in this element. They need a minimum of 86 mg/kg/day of calcium. Young growing puppies can utilize calcium fed in the form of sulfate, and this form is not inferior to that of milk. Balance experiments at different ages

TABLE 5. CALCIUM AND PHOSPHORUS BALANCES IN OLD DOGS.

Experiment No.	No. Dogs Used	Age (yrs.)	Mean Weight (kg.)	Diet (per cent)			Intake (mg./Kg./day)				Balance (mg./Kg./day)	
				Type	Calcium	Phosphorus	Calcium		Phosphorus		Calcium	Phosphorus
							Mean	Range	Mean	Range		
O-5	4	9-14	12.5	Horse Meat	0.06	0.34	8	(6- 9)	48	(40- 60)	−14 ± 6*	− 4±3*
O-IV	4	7- 8	10.8	Fibrin	0.20	0.31	28	(24- 32)	44	(37- 49)	−11 ± 8	− 7±6
O-VI	5	9-11	10.9	Casein	0.26	0.54	29	(25- 31)	61	(53- 66)	− 8 ± 4	0±5
O-2	5	9-15	24.3	Horse Meat	0.31	0.53	37	(24- 50)	63	(41- 85)	− 8 ± 5	3±7
O-1	5	9-11	11.4	Casein	0.30	0.70	42	(30- 48)	97	(70-113)	−17 ± 7	24±7
O-VIII	6	6-13	12.9	Fibrin	0.31	0.33	58	(40- 82)	53	(37- 75)	7 ± 4	5±3
O-4	6	7-14	13.8	Horse Meat	0.44	0.53	59	(48- 72)	72	(57- 87)	− 4 ± 6	10±6
O-3	5	9-15	24.3	Horse Meat	0.60	0.45	68	(37- 95)	51	(29- 71)	− 3 ± 4	− 8±4
O-III	5	9-11	11.1	Casein	0.68	0.68	86	(76- 91)	86	(76- 91)	0 ± 4	0±3
O-II	4	7- 8	10.7	Fibrin	0.72	0.37	130	(123-141)	67	(63- 72)	0 ±10	− 3±8
O-IX	6	6-13	13.2	Fibrin	0.94	0.30	168	(136-217)	53	(43- 68)	10 ±16	4±5
O-V	5	7-11	12.7	Casein	0.93	0.73	175	(156-195)	138	(123-153)	3 ±11	8±9
O-VII	3	8-12	11.3	Dog Meal	2.6	1.7	477	(414-514)	—	—	46 ±30	—

*Mean ± S.D.

TABLE 6. INTERRELATIONSHIP BETWEEN LIPIDS AND CALCIUM AND PHOSPHORUS BALANCES IN SIX OLD DOGS.
(Mean Age 12 Years)

Type of Fat	Diet Level (per cent)	Intake (mg./Kg./day)		Balance (mg./Kg./day)		Fecal Lipids (gm.) Excreted 10 Days		
		Calcium	Phosphorus	Calcium	Phosphorus	Total	Acids	Soaps
Tallow	5	143	94	8	7	27	15.5	11.4
Tallow	40	136	76	- 3	3	43	12.0	31.3
Corn Oil	40	134	78	-10	4	35	14.5	20.1
Corn Oil	5	132	89	1	10	18	10.3	7.5

during the growing period gave no evidence that the ability to utilize calcium in the form of calcium sulfate is related to age in the manner found for oxalate. A correlation of 0.95 was found between the excretions of calcium of the dog in milligrams per day, and the live weight in kilograms. For growing beagles a level of 0.5 per cent of calcium in the diet and a Ca/P ratio of 1.5 seems optimal. High levels of fat in the diet of old dogs seem to cause more wastage of calcium than 5 per cent fat levels. The hardness of the fat seems to have no influence upon calcium wastage. Exercise in old dogs seems to have a slightly favorable influence upon the retention of calcium.

This investigation was supported in part by a research grant from the U. S. Public Health Service,

TABLE 7. EFFECT OF MILD EXERCISE UPON THE CALCIUM AND PHOSPHORUS BALANCE OF OLD FEMALE DOGS.

Dog No.	Breed	Age (yrs.)	Weight (kg.)	Intake (mg./Kg./day)		Balance (mg./Kg./day)	
				Calcium	Phosphorus	Calcium	Phosphorus
			Without Exercise				
73	Beagle	9	13.0	48	48	- 7	2
66	Cocker	12	14.7	49	49	5	10
65	Cocker	14	11.7	50	50	3	6
64	Cocker	12	11.3	49	49	4	6
			With Exercise				
73	Beagle	9	12.8	47	47	-11	2
66	Cocker	12	14.9	47	46	17	18
65	Cocker	14	11.9	47	47	1	3
64	Cocker	12	11.4	47	47	11	10
			With Exercise				
66	Cocker	12	14.3	49	48	13	12
65	Cocker	14	11.9	47	47	8	8
64	Cocker	12	11.6	46	46	13	13

in part by a grant from the Office of Naval Research, and in part by a grant from the Rockefeller Foundation, and was conducted in the Nutrition Laboratory, Animal Husbandry Department, Cornell University, Ithaca, New York.

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Submitted for publication March 7, 1953

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Calcium, Phosphorus, Nitrogen, and Potassium Balance Studies in the Aged Male

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THE metabolic balance studies herein reported were designed primarily to examine the characteristics of calcium metabolism in individuals 65 years of age or older at several levels of calcium intake and a high level of nitrogen intake. Because of the relationship of calcium to phosphorus, nitrogen, and potassium in human tissues, these experiments also contain data concerning the metabolism of these elements.

Few previous studies have assayed the metabolism of specific elements in aged humans, particularly the metabolism of calcium, in an attempt to determine the requirement of specific elements for aged individuals.

Two reports on rats and hamsters from the laboratory of McCay (11, 12) suggested that the requirements of calcium for older animals might be greater than for the young, since these experiments reported a greater fecal loss of calcium for the older animals at any given level of intake. It was also found that increases in the fat content of the diet caused greater fecal losses of calcium in the old animals than in the young.

Previous reports upon the calcium metabolism of aged individuals include the two studies of Owen upon males in which he observed on one occasion patients up and about (19) and on another, patients kept in bed (18) and the study of Ohlsen and her associates upon aged females (24) in which the patients prepared the food themselves and rigorous metabolic balance conditions were not maintained.

The studies of Reifenstein and associates (21, 23) and of Shorr and Carter (25) have contributed greatly to an understanding of calcium metabolism of the aged individual with osteoporosis, but these studies have been primarily concerned with an evaluation of Vitamin D, strontium, estrogen, and androgen hormone administration and have not explored the question of the calcium requirement of aged males.

Published on a grant from the Forest Park Foundation.

EXPERIMENTAL METHODS

Subjects.—Seven ambulatory male patients of the Baltimore City Hospitals were selected on the basis of a detailed history, physical examination, and a series of laboratory studies. With the exception of the roentgenologic diagnosis of osteoporosis, these patients were considered to be free of disorders that might have primarily altered calcium, phosphorus, nitrogen, or potassium metabolism.

Pertinent laboratory findings are summarized in table 1 and brief clinical descriptions follow.

1. *H. C.*[1]—A 66 year old white, widowed male admitted to the hospital two and one-half years prior to the start of the study because of pressure injury to the right brachial nerve caused by the use of crutches for a fractured left tibia. He had worked as a painter during the greater part of his life and had sustained several fractures as a result of falls from scaffolding. These fractures readily healed, and he had always considered his general health to be excellent. Dental caries and gingivitis required the extraction of all his teeth ten years prior to admission. On admission, the patient appeared well, thin, and of medium height, with a complete set of prosthetic dentures, right arm weakness, and a fractured left tibia. In the ensuing weeks, the palsy regressed rapidly and the fracture healed well. He remained in the hospital for domiciliary care and had been in good health and active about the ward at the time the balance study was started.

2. *A. He.*—A 72 year old white, separated male, admitted one month prior to the first study for the repair of a left inguinal hernia. He had been employed as a tile and slate roofer and then at small odd jobs in the five years preceding admission. He

[1] This patient served as subject in a previous metabolic balance study (6).

TABLE I. COMPARISONS OF DESIGNS

	STUDY I	STUDY II
Number of Patients	3	5
Length of Periods	7 days	5 days
Number of Periods at One Intake Level	4 - 5	5
Sequence of Calcium Intake Levels	107, 849, 1524	1600, 292, 859, 131
Form of Calcium Fed	All in foods of diet	Base diet contained 131 mg. higher levels made by adding calcium gluconate
Nitrogen and Phosphorous Levels of Diet	N: moderately constant P: increased as calcium increased	Both nitrogen and phosphorous constant throughout*

*Potassium intake also constant in Study II. Potassium was not analyzed in Study I.

had been in excellent health except for pain associated with his hernia. There was no history of any fractures. All his teeth had been removed at the age of 56 years, and replaced by satisfactory artificial dentures. He appeared well, younger than his stated age, of medium height, with a large-frame build, moderately muscular in development. Positive findings on admission in addition to the left inguinal hernia included moderate enlargement of the prostate and a palpable, soft, smooth, non-tender liver edge extending 2 cm. below the right costal margin. Shortly after admission he underwent repair of the hernia with a satisfactory post-operative course. He had been fully ambulant for ten days before the start of the first study. In the year between the first and second metabolic balance experiments, he was well, up and about the ward, having remained in the hospital for domiciliary care.

3. *W. Ra.*—An 83 year old, white, widowed male admitted five months before the onset of the study for domiciliary care. For the greater part of his life the patient had worked as a house painter, retiring at age 65 years. He had always considered his general health to be excellent, noting only mild constipation and dental caries. All teeth were removed at the age of 70 years and replaced by poorly fitting false teeth which he did not use. He was struck by an automobile at the age of 72 and sustained a fractured right humerus. Six years later, in similar fashion, the left radius and left second toe were broken. Healing was rapid and uneventful. The patient was of medium height, slightly obese, and of a large, broad build. On admission, the positive findings included occasional runs of a bigeminal pulse (without evidence of hypertension, cardiac enlargement, or increased venous pressure), and a moderately enlarged prostate. Prior to the beginning of the study he had been up and out of bed. During the study, he spent most of his time sitting in a chair reading.

4. *J. D.*—A 68 year old white single male who was admitted one year prior to the start of the study for domiciliary care. The patient had been employed variously as a merchant seaman, carpenter, and house painter. He had always considered his general health to be good except for occasional mild upper respiratory tract infections and gingivitis which necessitated the removal of all his teeth three years prior to admission. There was no history of any fractures. On examination he appeared of medium height and build. The only positive finding was bilateral varicose veins of the lower extremities without ulceration or edema. The patient had been active about the ward during the period before the beginning of the balance experiment.

5. *G. S.*—A 75 year old white, widowed male, admitted to the City Infirmary for domiciliary care four years before the study. The patient had worked almost all of his life as a butcher or grocery salesman and retired to the Infirmary because of recurrent leg infections secondary to bilateral varicose veins. These had been treated successfully at the time of admission. He had always considered his general health to be good, except for dental caries and pyorrhea which required the removal of all his teeth at the age of 45 years. There was no history of any fractures. On admission, he appeared well, a strikingly short, moderately obese individual. Positive findings included pigmentation of both lower legs, bilateral saphenous vein varicosities (without peripheral edema), complete edentia, slight cardiac enlargement to the left with a soft, short systolic murmur heard over the apex, a small umbilical hernia, and a symmetrically enlarged soft prostate. He had been working at odd jobs in the Infirmary just before being admitted for the metabolic study.

6. *T. B.*[2]—A 70 year old white, single, Polish-born

[2] This patient served as subject in a previous metabolic balance study (5).

male admitted two and one-half years prior to the start of the study for domiciliary care. The patient had been a laborer all of his life and stopped work shortly before admission because of low back pain. He always considered himself to be in excellent health. The patient had sustained a fracture of the right thumb at the age of 25 years. There was no history of any other fractures. The low back pain was relieved when the patient stopped his heavy-duty work. He was a tall, heavily built individual who seemed well. On examination, the positive findings included a scarred right ear drum and marked dental caries with gum retraction. Most of the patient's teeth were present. His course had been unremarkable in the hospital, and he was up and about the ward at all times prior to the start of the study.

7. *A. A.*—A 77 year old white single male admitted for domiciliary care one year prior to the start of the study. The patient had worked as a court clerk, school teacher, and then finally as a restaurant employee. Eventually he retired because of dyspnea on exertion. His past history included mild alcoholism as a young man, a five year period of morphine addiction during his late forties, and recurrent respiratory tract infections. During the ten years prior to admission, exertional dyspnea gradually developed, associated with a chronic cough, and productive of small amounts of white mucoid sputum. All of his teeth were removed because of pyorrhea at the age of 42 years. There was no history of any fractures. He appeared thin and was of medium height. On admission, his lips were a dusky hue. The costal cage was held toward the inspiratory position, the subcostal angle was wide, the diaphragm low and occasional moist rales were heard at the right base posteriorly. Flouroscopic and laboratory findings confirmed the clinical diagnosis of pulmonary emphysema with some degree of fibrosis. He gained 23 pounds during his course in the hospital. Two episodes of a respiratory tract infection were rapidly controlled with penicillin. He had been up and about the ward without complaints of respiratory distress before the study began.

Procedure.—Two separate metabolic balance studies were conducted upon the 7 individuals described. (1 individual was studied twice). Study I was run during March-July, 1951, study II during March-June, 1952. The two studies differed in design as indicated in table

TABLE 2. DIETS -- STUDY I

MENU I (periods 1 - 5)		MENU II (periods 6 - 9)		MENU III (periods 10 - 13)	
BREAKFAST		BREAKFAST		BREAKFAST	
	Gms.		Gms.		Gms.
Applesauce	100	Canned Grapefruit	100	Pineapple Juice	200
Grapefruit Juice	200	Wheat Flakes	30	Grapenut Flakes	30
Bread*	150	Bread*	150	Bread*	150
Margarine*	25	Margarine*	45	Margarine*	50
Sugar*	10	Sanka*	3 pkgs.	Sanka*	3 pkgs.
Honey*	70	Sugar*	40	Sugar*	20
Sanka	1 pkg.	Jelly*	90	Jelly*	90
		Evaporated Milk	100	Evaporated Milk	300
		Cheddar Cheese	60		
LUNCH		LUNCH		LUNCH	
Beef	150	Beef	120	Beef	60
Macaroni	30	Potato	100	Potato	100
Corn	100	Peas	100	Tomatoes	100
Pears	100	Pineapple	150	Applesauce	100
Hard Candy	50	Hard Candy	15		
SUPPER		SUPPER		SUPPER	
Pork	190	Pork	60	Cheddar Cheese	90
Rice	30	Macaroni	30	Rice	30
Tomatoes	100	Carrots	100	Green Beans	100
Peaches	100	Apricots	100	Peaches	100
Gingerale	300				

*Foods were initially served at breakfast, but were also served at the other meals. The figures listed indicate the total amount of that food served during the day.

2. The important feature of difference is the sequence of intake levels of calcium: in the first experiments the calcium intake was progressively increased from very low to high levels (107, 849, 1543 mg./day), whereas in the second set of experiments the intake level sequence ran from high (1600) to low (292) to intermediate (859) to extremely low (131).

Table 3 lists the menus used during the studies, and table 4 lists the chemical analysis of these diets and their calculated caloric and fat content. The patients also received 15,000 International Units (IU) of Vitamin A and 1500 IU of Vitamin D daily in capsule form.

The first study was divided into 13 seven day periods with 5, 4, and 4 periods at each level of calcium intake. The second study consisted of 5 five day periods at each of 4 levels of intake. Aliquots of daily urine volumes were pooled at the end of the period. Stool collections were marked by carmine. An aliquot of the pooled collection was used for analysis. Serum samples were drawn and the patients weighed shortly after arising and before breakfast. Food was served from a kitchen used solely for the experiments. The patients ate all of the foods served and were allowed no other food. To check on the completeness of all the foods being eaten, the dishes of one patient were saved throughout period 5 and washed with distilled water. This wash was then ashed and analyzed and the amount of the elements found to be "left over" 1 day was as follows: calcium 2.4 mg., phosphorus 13.3 mg., nitrogen 0.0, potassium 1.1 mEq. During the second study, subjects A. He., and G. S. were not started until period 2.[3]

Chemical Methods.—Aliquots of the diet and feces were obtained by the "wet method" described by Reifenstein, Albright, and Wells (22). Dietary, urinary, and fecal nitrogen were determined by a macro-Kjeldahl method, and plasma protein by a micro-Kjeldahl method (10). Plasma albumin was determined by the micro-Kjeldahl method after precipitation of globulin with sodium sulfate (13). Calcium was determined according to the method of Fiske and Logan (7), phosphorus by the method of Fiske and Subbarow (8), serum alkaline phosphatase by a modification of the method of Bodansky (3)[4], and urinary creatinine as described by Peters (20). Potassium analyses were completed only in study II, and were performed on an internal standard flame photometer according to the method of Bowman and Berliner (4).

[3] Estimates of the actual daily food consumption of these patients when on the hospital diet were as follows: Calories, 1200 to 2000; Nitrogen, 6 to 12 Gm.; Phosphorus, 1.0 to 1.1 Gm.; Potassium, 40 to 50 mEq.

[4] 0.5 cc. samples of serum were incubated for one hour at 37° C. in a volume of 10.5 ml. containing 3.92 Gm. barbital sodium per 100 ml. and 2.98 Gm. sodium β-glycerophosphate per 100 ml. The liberated phosphate was determined by the method of Fiske and Subbarow (8).

TABLE 3. ANALYSIS OF DIETS -- DAILY INTAKES

Study	Diet (periods)	Calcium (mgm.)	Phosphorous (mgm.)	Nitrogen (Gm.)	Potassium (mEq.)	Calculated	
						Fat (Gm.)	Calories
I	I (1-5)	107	1100	16.5	--	102	2785
	II (6-9)	859	1608	15.3	--	104	2690
	III (10-13)	1543	2024	13.7	--	105	2590
II	I (Days 1 & 4)	138	1123	16.1	75	122	2610
	II (Days 2 & 5)	138	1193	17.4	78	122	2607
	III (Day 3)	109	1194	17.2	66	122	2632

TABLE 4. PATIENT DESCRIPTION -- LABORATORY DATA

Tests	H. C.	A. He	W. Ra	J. D.	T. B.	A. A.	G. S.
URINE							
Sp. Grav.	1.012	1.017	1.012	1.019	1.018	1.023	1.014
pH	6.0	6.0	6.0	5.0	5.0	6.0	5.0
Albumin	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Sugar	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Micro.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
BLOOD							
Hb	13.6	15.5	12.6	13.0	14.5	13.5	13.5
RBC	3.9	4.2	4.2	--	4.8	4.5	4.7
WBC	11.4	8.8	7.0	5.3	5.3	5.7	5.7
STS	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
NPN	27	34	46	36	36	37	34
Sugar	88	81	83	76	83	83	88
Protein	7.2	7.0	6.7	6.2	6.8	7.8	7.0
Ca	9.4	9.6	9.2	10.1	9.3	10.5	9.4
P	2.6	2.8	2.9	3.5	3.6	2.9	2.5
Alk. Phos.	3.3	3.5	6.9	4.3	2.0	1.3	3.9
X-RAYS							
Chest	Lung fields clear; heart size normal	Lung fields clear; heart size normal	Lung fields clear; heart slightly enlarged	Lung fields clear; heart size normal	Lung fields clear; heart size normal	Pulmonary emphysema and fibrosis; heart size increased 15%	Lung fields clear; heart size normal
IVP	Unremarkable	Unremarkable	Unremarkable	Unremarkable	Unremarkable	Unremarkable	Urinary bladder diverticulum
G. I. Series	Unremarkable	Unremarkable	Unremarkable	Unremarkable	Unremarkable	- - - - -	Unremarkable
Barium Enema	Unremarkable	Diverticuli throughout colon	Unremarkable	Unremarkable	Unremarkable	- - - - -	Diverticuli throughout colon
Skeletal Survey	No osteoporosis; old healed fractures	Slight osteoporosis; old healed fractures	Moderate osteoporosis; moderate osteoarthritis	No osteoporosis; moderate osteoarthritis	No osteoporosis; slight osteoarthritis	No osteoporosis; slight osteoarthritis	Marked osteoporosis
STOOL*	Negative	Negative	Negative	Negative	Negative	Negative	Negative
GASTRIC ACID	Free acid	Free acid	No free acid after histamine	Free acid	Free acid	Free acid	Free acid
ECG	Normal	Normal	Normal	Normal	Normal	Left axis deviation	Normal

*Stools examined for: form blood, ova, parasites.

RESULTS

The results are given in tables 5 to 8 and summarized graphically in figures 1 to 8. The figures are plotted according to the method suggested by Reifenstein, Albright, and Wells (22). The intake is plotted down from the zero line of the ordinate. The sum of the fecal and urinary excretion is plotted upward from the intake line. A clear area between the excretion column and the zero line represents a positive balance. If the excretion area goes above the zero line, the balance is negative. The scale for time is given as seven or five day periods along the abscissa. The data are represented as quantities per 24 hours and plotted on scales which indicate approximate interrelationships in body tissue (i. e., 3 Gm. of nitrogen are equivalent to 200 mg. of phosphorus, 400 mg. of calcium, and 8 mEq. of potassium). These scales are based on the following ratios: N/P in muscle, 14.7; Ca/P in bone, 2.23; K/N in muscle, 2.7 (1).

Nitrogen Balance.—In all 8 experiments, nitrogen was retained almost constantly throughout the entire experiment, the sole exception was subject A. He., who during periods

TABLE 5. METABOLIC DATA ON SUBJECTS -- STUDY 1 (March 6 - July 3)

Subject	Period	Wgt. of Patient (kg.)	Nitrogen (Gm./day)				Phosphorous (mg./day)				Calcium (mg./day)				Serum					
			Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Calcium (mg. %)	Phosphorous (mg. %)	Alkaline Phosphatase*	Total Protein (Gm. %)	Albumin (Gm. %)	Globulin (Gm. %)
H.C.	1	56.3	13.4	10.1	1.6	1.7	927	691	331	- 95	102	101	263	-261						
	2	56.2	16.5	12.8	1.6	2.1	1101	764	259	78	107	118	110	-120	9.35	2.63	3.29	7.24	4.58	2.66
	3	56.7	16.5	13.2	1.7	1.6	1101	798	273	30	107	123	98	-114	9.45	3.07	3.79	7.28	4.87	2.41
	4	56.7	16.5	12.8	1.8	1.9	1101	788	266	47	107	118	103	-113	9.35	2.97	4.69	7.48	4.88	2.60
	5	57.0	16.4	12.0	1.8	2.6	1111	744	251	116	103	119	80	- 96	9.28	2.84	4.80	7.14	4.50	2.64
	6	56.9	15.3	10.8	2.4	2.1	1608	985	433	190	859	150	574	135	9.62	3.14	4.06	7.25	4.64	2.61
	7	57.6	15.3	10.8	2.8	1.7	1608	990	624	- 60	859	119	749	- 10	9.58	2.71	5.33	7.12	4.67	2.45
	8	57.0	15.3	11.1	2.0	2.2	1608	999	469	140	859	123	615	121	10.02	2.96	5.15	7.57	4.82	2.75
	9	57.5	15.3	11.1	2.4	1.8	1608	982	520	106	859	123	670	66	9.30	2.86	4.46	7.43	4.74	2.69
	10	57.7	13.7	9.8	2.3	1.6	2024	1066	708	250	1543	124	1156	263	9.20	3.19	5.05	7.92	4.66	3.26
	11	58.0	13.7	9.5	2.6	1.6	2024	1086	833	105	1543	127	1379	37	9.50	2.98	4.23	7.36	4.82	2.54
	12	58.3	13.7	9.7	2.2	1.8	2024	1102	748	174	1543	117	1218	208	9.20	3.15	4.32	7.35	4.71	2.64
	13	57.9	13.7	9.8	2.3	1.6	2024	1096	771	157	1543	122	1261	160	9.15	3.38	4.80	7.56	4.83	2.73
A. He	1	64.0	13.4	9.1	0.9	3.4	927	561	233	133	102	87	158	-143	9.60	2.78	3.51	6.99	3.98	3.01
	2	64.6	16.5	11.0	0.7	4.8	1101	598	203	300	107	104	95	- 92	10.62	2.35	3.75	7.62	4.57	3.05
	3	65.6	16.5	11.6	0.8	4.1	1101	680	224	197	107	109	96	- 98	10.45	2.98	4.42	7.69	4.78	2.91
	4	66.2	16.5	11.9	0.7	3.9	1101	696	220	185	107	104	95	- 92	10.40	2.92	4.66	7.84	5.07	2.77
	5	66.6	16.4	12.2	0.9	3.3	1111	725	275	111	103	104	107	-107	10.18	2.94	5.43	7.62	4.71	2.91
	6	66.8	15.3	10.8	1.5	3.0	1608	929	529	150	859	154	558	147	10.30	3.06	4.52	7.65	4.90	2.75
	7	67.6	15.3	11.0	1.3	3.0	1608	869	568	171	859	147	657	55	10.38	2.78	6.58	7.38	4.93	2.45
	8	68.1	15.3	11.5	1.1	2.7	1608	881	580	147	859	142	668	49	10.36	2.91	6.28	7.72	4.41	3.31
	9	68.4	15.3	11.6	0.9	2.8	1608	913	513	182	859	132	594	133	10.18	2.97	5.51	7.59	4.79	2.80
	10	68.8	13.7	10.7	1.0	2.0	2024	1034	651	339	1543	155	998	340	10.68	3.11	5.52	7.85	4.86	2.99
	11	69.0	13.7	10.5	1.1	2.1	2024	1058	807	159	1543	155	1351	37	10.72	3.03	5.58	7.52	4.86	2.66
	12	69.4	13.7	10.8	1.2	1.7	2024	1059	822	143	1543	151	1287	105	10.20	3.16	5.56	7.60	4.89	2.71
	13	69.1	13.7	10.6	1.2	1.9	2024	1102	810	112	1543	142	1369	32	9.92	3.41	6.03	7.05	4.88	2.17

All periods 7 days in length. All balances are positive unless marked negative (-).

*Bodansky Units.

TABLE 6. METABOLIC DATA ON SUBJECTS -- STUDY 1 (March 6 - July 3)

Subject	Period	Wgt. of Patient (kg.)	Nitrogen (Gm./day)				Phosphorous (mg./day)				Calcium (mg./day)				Serum					
			Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Calcium (mg. %)	Phosphorous (mg. %)	Alkaline Phosphatase*	Total Protein (Gm. %)	Albumin (Gm. %)	Globulin (Gm. %)
W. Ra	1	71.7	13.4	10.2	1.8	1.4	928	508	464	- 44	108	46	45	17	9.25	2.92	6.94	6.67	4.09	2.58
	2	72.0	16.5	10.9	2.2	3.4	1102	530	368	204	113	56	158	-101	9.55	2.30	6.81	6.82	4.46	2.36
	3	73.7	16.5	11.2	3.1	2.2	1102	596	565	- 59	113	50	202	-139	8.95	2.92	6.45	6.83	4.46	2.37
	4	73.7	16.5	11.3	2.4	2.8	1102	605	433	64	113	47	150	- 84	9.35	2.86	7.70	6.98	4.52	2.46
	5	74.1	16.4	11.6	2.2	2.6	1111	589	391	131	109	46	119	- 56	9.32	2.86	7.20	6.88	4.45	2.43
	6	74.4	15.3	10.0	3.1	2.2	1608	652	837	119	859	60	731	68	9.50	3.09	7.28	7.17	4.85	2.32
	7	75.0	15.3	10.3	2.5	2.5	1608	660	818	130	859	47	736	76	9.92	3.08	7.87	6.89	4.57	2.32
	8	75.7	15.3	10.3	2.5	2.5	1608	626	834	148	859	46	736	77	9.20	3.01	7.10	6.72	4.89	1.83
	9	76.0	15.3	10.2	2.6	2.5	1608	705	799	104	859	47	723	89	9.40	3.12	6.70	6.93	4.61	2.32
	10	75.7	13.7	8.8	2.2	2.7	2024	596	957	471	1543	44	1115	384	9.08	3.35	6.57	7.25	4.76	2.49
	11	76.0	13.7	8.5	2.9	2.3	2024	610	1352	62	1543	28	1552	- 37	9.08	3.26	6.79	6.92	4.84	2.08
	12	76.4	13.7	9.4	2.5	1.8	2024	685	1212	127	1543	32	1396	115	9.15	3.23	6.07	6.85	4.51	2.34
	13	77.4	13.7	9.2	2.3	2.2	2024	652	1149	223	1543	27	1283	233	8.78	3.32	7.10	6.92	4.58	2.34

All periods 7 days in length. All balances are positive unless marked negative (-).

*Bodansky Units.

13 and 14 of the second study was in slight negative balance. The magnitude of this daily nitrogen retention gradually diminished during the course of the study in 5 individuals (A. He. twice, H.C., W. Ra., G.S., A.A.). At the outset the daily nitrogen storage ranged from 2.5 to 4.0 Gm./day, and diminished to levels of 1.0 to 2.0 Gm./day. In 2 individuals, the magnitude of the nitrogen storage remained approximately the same (J.D.: 2.5-3.0 Gm./day; T.B.: 1.5-2.0 Gm./day).

Weight.—All but 1 patient (T.B.) gained

TABLE 7. METABOLIC DATA ON SUBJECTS -- STUDY II (March 13 - June 20)

	Period	Wgt. of Patient (kg.)	Nitrogen (Gm. /day)				Phosphorous (mg. /day)				Calcium (mg. /day)				Potassium (mEq. /day)				Serum						
			Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Calcium (mg. %)	Phosphorous (mg %)	Alkaline Phosphatase*	Total Protein (Gm. %)	Albumin (Gm. %)	Globulin (Gm. %)	Potassium (mEq./L.)
A	1	55.3	16.8	12.1	1.3	3.4	1165	520	385	260	1602	87	1161	354	74.0	36.4	11.1	26.5	10.05	2.83	2.87	6.90	4.62	2.28	5.13
	2	55.2	16.8	12.9	1.4	2.5	1165	491	368	306	1602	57	1348	197	74.0	43.2	11.0	19.8	--	--	--	--	--	--	--
	3	56.0	16.8	12.9	1.9	2.0	1165	509	510	146	1602	69	1859	-326	74.0	43.4	16.4	14.2	9.92	2.78	2.95	7.34	4.72	2.62	5.22
	4	56.6	16.8	13.1	1.0	2.7	1165	518	326	321	1602	81	1114	407	74.0	47.7	7.6	18.7	--	--	--	--	--	--	--
	5	56.5	16.8	12.9	1.6	2.3	1165	540	497	128	1602	74	1636	-108	74.0	45.3	13.8	14.9	--	--	--	--	--	--	--
	6	56.8	16.8	12.7	1.3	2.8	1165	672	338	155	292	29	570	-307	74.0	47.4	11.0	15.6	11.38	3.05	3.94	7.64	4.88	2.76	4.90
	7	56.8	16.8	12.3	1.6	2.9	1165	664	324	177	292	40	283	- 31	74.0	42.6	12.3	19.1	--	--	--	--	--	--	--
	8	57.0	16.8	13.1	1.3	2.4	1165	715	229	221	292	50	195	47	74.0	44.5	10.7	18.8	10.30	--	--	--	--	--	5.00
	9	57.1	16.8	13.1	1.8	1.9	1165	574	338	253	292	54	306	- 68	74.0	45.4	14.1	14.5	--	2.77	3.44	7.02	4.47	2.55	--
	10	57.4	16.8	13.2	1.8	1.8	1165	722	338	105	292	60	306	- 74	74.0	42.9	16.0	15.1	--	--	--	--	--	--	--
	11	57.6	16.7	13.5	1.6	1.6	1132	665	356	111	818	100	638	80	72.2	45.6	11.5	15.1	10.42	2.90	3.26	7.20	4.12	3.08	4.26
	12	57.5	16.7	13.3	1.4	2.0	1132	622	339	171	818	89	719	10	72.2	43.6	9.8	18.8	--	--	--	--	--	--	--
	13	58.1	16.7	13.0	1.8	1.9	1132	659	394	79	818	76	828	- 86	72.2	47.7	13.0	11.5	10.80	3.15	3.22	7.14	4.21	2.93	5.22
	14	58.4	16.7	13.1	1.2	2.4	1132	619	269	244	818	89	583	146	72.2	43.5	8.7	20.0	--	--	--	--	--	--	--
	15	58.2	16.7	12.9	1.7	2.1	1132	616	408	108	818	88	807	- 77	72.2	43.1	12.1	17.0	--	--	--	--	--	--	--
	16	58.1	17.3	13.2	1.5	2.6	1094	694	283	117	132	39	362	-269	71.8	44.0	11.0	16.8	10.75	3.16	4.43	7.75	4.53	3.22	5.19
	17	58.4	17.3	14.5	1.8	1.0	1094	735	293	66	132	46	189	-103	71.8	45.5	13.6	12.7	--	--	--	--	--	--	--
	18	58.3	17.3	14.2	2.0	1.1	1094	718	328	48	132	47	237	-152	71.8	48.5	15.6	7.7	10.08	2.95	4.07	7.44	4.29	3.15	4.65
	19	58.3	17.3	14.0	1.3	2.0	1094	751	219	124	132	75	298	-241	71.8	44.5	20.9	6.4	--	--	--	--	--	--	--
	20	58.5	17.3	14.2	1.3	1.8	1094	767	219	108	132	60	298	-266	71.8	48.3	20.9	2.6	--	--	--	--	--	--	--
B	1	85.4	16.8	13.9	1.8	1.1	1165	848	416	- 99	1600	167	1426	7	74.7	56.9	8.2	9.6	9.58	3.01	4.67	7.70	4.87	2.83	4.36
	2	85.3	16.8	14.2	1.8	0.8	1165	709	406	50	1600	160	1469	- 29	74.7	52.8	9.7	12.2	--	--	--	--	--	--	--
	3	85.0	16.8	13.9	1.8	1.1	1165	652	361	152	1600	182	1309	109	74.7	50.3	9.9	14.5	10.50	2.76	4.52	7.79	4.87	2.92	4.80
	4	85.3	16.8	13.9	1.2	1.7	1165	652	328	185	1600	205	1085	310	74.7	53.3	6.6	14.8	--	--	--	--	--	--	--
	5	84.7	16.8	13.8	1.5	1.5	1165	706	366	93	1600	176	1260	164	74.7	54.8	8.3	11.6	--	--	--	--	--	--	--
	6	84.5	16.8	14.3	1.5	1.0	1165	836	466	-137	290	120	1018	-848	74.7	57.1	10.7	6.9	11.12	2.56	5.68	7.81	4.35	3.46	4.39
	7	84.6	16.8	14.4	0.8	1.6	1165	825	190	150	290	148	182	- 40	74.7	55.9	4.0	14.8	--	--	--	--	--	--	--
	8	84.4	16.8	14.5	1.5	0.8	1165	858	376	- 69	290	161	354	-225	74.7	58.4	8.3	8.0	10.62	--	--	--	--	--	4.68
	9	84.4	16.8	14.1	0.4	2.3	1165	727	88	350	290	152	84	54	74.7	58.6	2.2	13.9	--	2.65	5.76	7.57	4.31	3.26	--
	10	84.4	16.8	14.3	0.9	1.6	1165	764	274	127	290	160	297	-167	74.7	58.3	5.0	11.4	--	--	--	--	--	--	--
	11	84.2	16.7	13.8	1.9	1.0	1132	760	507	-135	816	193	769	-146	72.9	53.3	11.4	8.2	11.20	3.16	5.48	7.77	3.54	4.23	4.48
	12	84.1	16.7	13.9	1.2	1.6	1132	748	313	71	816	186	704	- 74	72.9	52.6	6.9	13.4	--	--	--	--	--	--	--
	13	84.1	16.7	13.9	1.0	1.8	1132	756	270	106	816	189	585	42	72.9	56.9	5.8	10.2	11.05	2.86	5.90	7.47	4.37	3.10	5.08
	14	84.2	16.7	13.9	0.8	2.0	1132	783	192	157	816	189	435	192	72.9	56.6	3.6	12.7	--	--	--	--	--	--	--
	15	83.6	16.7	14.0	1.4	1.3	1132	764	379	- 11	816	194	862	-240	72.9	56.8	7.6	8.5	--	--	--	--	--	--	--
	16	83.7	17.3	14.6	1.6	1.1	1094	809	432	-147	131	131	684	-684	72.5	57.4	10.5	4.6	11.05	2.88	8.27	--	--	--	--
	17	83.6	17.3	14.6	1.3	1.4	1094	785	278	31	131	144	239	-252	72.5	53.9	10.1	8.5	--	--	--	--	--	--	--
	18	83.9	17.3	14.2	1.7	1.4	1094	813	288	- 7	131	167	224	-260	72.5	49.2	11.8	11.5	11.30	2.67	6.53	8.22	4.36	3.86	4.20
	19	84.0	17.3	14.1	0.7	2.5	1094	827	102	165	131	174	76	-119	72.5	50.0	3.4	19.1	--	--	--	--	--	--	--
	20	83.2	17.3	14.2	1.8	1.3	1094	878	346	-130	131	174	231	-274	72.5	55.2	11.8	5.5	--	--	--	--	--	--	--

All periods 5 days in length. All balances are positive unless marked negative (-).

Subject A = A. A. Subject B = T. B.

*Bodansky Units.

weight during the course of the study. This single exception was the largest of the subjects (86 Kg.) and it may well have been that the caloric value of the diet fell below his needs.

The net changes in weight for each were as follows: H.D. = +2.0 Kg.; A. He. = +6.0 Kg. (first study), +2.1 Kg. (2nd study); W. Ra. = +5.1 Kg.; J.D. = +2.2 Kg.; G. S. = +1.3 Kg.; T.B. = —2.9 Kg.; A.A. = +3.9 Kg.

Phosphorus Balance.—For the most part, all patients are in positive phosphorus balance throughout the experiment. The magnitude of the phosphorus retention was approximately proportioned to the magnitude of the nitrogen balance. Period to period variations were marked in W. Ra., T.B., and A. He. These variations appear to reflect period to period change in stool phosphorus and probably indicate demarcation overlaps in stool collections. The fecal excretion of phosphorus of the patients during the second study were highest during the high calcium intake and lowest during the low calcium intake. No consistent effect of the calcium intake upon the phosphorus balance is apparent, and in the first study the

TABLE 8. METABOLIC DATA ON SUBJECTS -- STUDY II (March 13 - June 20)

	Period	Wt. of Patient (kg.)	Nitrogen (Gm./day)				Phosphorous (mg./day)				Calcium (mg./day)				Potassium (mEq./day)				Serum						
			Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Calcium (mg.%)	Phosphorous (mg.%)	Alkaline Phosphatase*	Total Protein (Gm.%)	Albumin (Gm.%)	Globulin (Gm.%)	Potassium (mEq./L.)
C	1	74.2	16.8	11.6	2.1	3.1	1165	621	431	113	1600	215	1179	206	74.7	51.1	15.0	8.6	9.75	3.46	3.76	7.28	4.93	2.34	4.69
	2	75.0	16.8	12.1	2.1	2.6	1165	478	469	218	1600	227	1366	7	74.7	40.7	15.9	18.1	--	--	--	--	--	--	--
	3	75.2	16.8	11.1	2.5	3.2	1165	472	505	188	1600	225	1337	38	74.7	38.8	21.2	14.7	9.72	2.50	3.55	7.82	5.27	2.55	4.05
	4	75.3	16.8	12.1	1.8	2.9	1165	541	342	282	1600	295	931	374	74.7	41.8	12.5	20.4	--	--	--	--	--	--	--
	5	75.3	16.8	11.5	2.7	2.6	1165	540	465	160	1600	261	1254	85	74.7	44.7	15.6	14.4	--	--	--	--	--	--	--
	6	75.0	16.8	11.6	2.5	2.7	1165	668	357	140	290	162	298	-170	74.7	45.6	11.4	15.7	10.20	2.56	3.96	7.65	5.08	2.57	4.04
	7	75.4	16.8	10.7	2.5	3.6	1165	679	303	183	290	150	137	3	74.7	43.4	13.9	17.4	--	--	--	--	--	--	--
	8	75.4	16.8	11.8	2.2	2.8	1165	646	275	244	290	185	121	- 16	74.7	45.7	12.1	16.9	9.88	--	--	--	--	--	4.74
	9	75.4	16.8	11.7	3.4	1.7	1165	701	402	62	290	179	158	- 47	74.7	47.4	18.4	8.9	--	2.52	4.00	7.38	4.57	2.81	--
	10	75.4	16.8	11.6	2.0	3.2	1165	680	238	247	290	188	85	17	74.7	44.7	11.3	18.7	--	--	--	--	--	--	--
	11	75.4	16.7	11.3	3.1	2.3	1132	624	420	88	816	278	364	174	72.9	42.9	18.9	11.1	10.05	2.53	4.20	7.48	4.72	2.76	4.14
	12	76.4	16.7	11.9	2.4	2.4	1132	602	356	174	816	266	362	188	72.9	43.0	14.1	15.8	--	--	--	--	--	--	--
	13	75.7	16.7	11.7	2.4	2.6	1132	598	313	221	816	262	360	194	72.9	46.5	12.1	14.3	10.30	3.22	4.44	7.44	4.74	2.70	5.28
	14	75.9	16.7	11.3	2.7	2.7	1132	628	328	176	816	243	410	163	72.9	43.1	14.6	15.2	--	--	--	--	--	--	--
	15	75.8	16.7	10.8	2.8	3.1	1132	583	353	196	816	243	400	173	72.9	40.8	15.1	17.0	--	--	--	--	--	--	--
	16	75.9	17.3	10.9	2.6	3.8	1094	594	309	191	131	163	155	-187	72.5	39.2	13.1	20.2	10.45	2.93	5.29	--	--	--	--
	17	76.4	17.3	12.8	2.7	1.8	1094	706	300	88	131	148	92	-109	72.5	43.7	16.5	12.3	--	--	--	--	--	--	--
	18	76.2	17.3	12.4	3.2	1.7	1094	709	327	55	131	158	106	-133	72.5	42.2	18.8	11.5	11.32	2.75	4.84	7.24	4.49	2.75	3.98
	19	76.2	17.3	11.6	2.6	3.1	1094	652	271	171	131	166	83	-118	72.5	39.4	13.6	19.5	--	--	--	--	--	--	--
	20	76.2	17.3	11.8	2.7	2.8	1094	710	290	94	131	177	86	-132	72.5	46.4	14.4	11.7	--	--	--	--	--	--	--
D	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2	73.8	16.9	11.4	0.5	5.0	1170	606	160	404	1597	145	575	877	73.2	41.2	6.4	22.6	--	--	--	--	--	--	--
	3	74.4	16.8	12.5	0.9	3.4	1165	531	271	363	1600	159	927	517	71.7	42.2	13.6	18.9	10.15	2.44	3.67	7.87	4.92	2.95	4.65
	4	75.0	16.8	12.3	1.1	3.4	1165	539	397	229	1600	179	1345	76	74.7	35.7	16.4	22.6	--	--	--	--	--	--	--
	5	75.2	16.8	12.7	0.7	3.4	1165	569	294	302	1600	175	916	509	74.7	36.1	13.1	25.5	--	--	--	--	--	--	--
	6	75.1	16.8	12.9	0.6	3.3	1165	710	222	233	290	99	667	-476	74.7	37.7	15.7	21.3	11.05	2.48	4.74	7.87	4.78	3.09	4.80
	7	75.0	16.8	13.3	0.9	2.6	1165	715	366	84	290	105	900	-715	74.7	43.3	19.1	12.3	--	--	--	--	--	--	--
	8	75.2	16.8	13.4	0.7	2.7	1165	775	234	156	290	128	249	- 87	74.7	41.2	14.7	18.8	10.02	--	--	--	--	--	5.27
	9	75.3	16.8	12.9	1.7	2.2	1165	722	499	- 56	290	122	443	-275	74.7	42.9	20.2	11.6	--	2.41	4.52	7.79	4.24	3.55	--
	10	75.6	16.8	13.3	0.5	3.0	1165	746	128	291	290	118	102	70	74.7	50.7	9.0	15.0	--	--	--	--	--	--	--
	11	75.5	16.7	13.3	0.7	2.7	1132	699	232	201	816	173	205	438	72.9	47.9	11.8	13.2	10.52	2.37	5.27	7.44	4.40	3.04	4.40
	12	75.4	16.7	13.5	0.8	2.4	1132	633	364	135	816	166	468	182	72.9	45.2	15.5	12.2	--	--	--	--	--	--	--
	13	75.8	16.7	16.3	0.8	-0.4	1132	673	456	3	816	176	768	-128	72.9	48.6	13.3	11.0	10.70	2.70	5.75	7.58	4.08	3.50	5.11
	14	75.6	16.7	16.1	0.8	-0.2	1132	712	453	- 33	816	174	772	-130	72.9	50.5	13.8	8.6	--	--	--	--	--	--	--
	15	75.6	16.7	13.9	1.0	1.8	1132	681	495	- 44	816	168	871	-223	72.9	42.9	19.1	10.9	--	--	--	--	--	--	--
	16	75.5	17.3	14.4	0.5	2.4	1094	740	251	103	131	127	391	-387	72.5	47.0	11.6	13.9	11.30	2.87	7.77	7.90	4.35	3.55	4.69
	17	75.5	17.3	14.7	1.6	1.0	1094	772	444	-122	131	143	339	-351	72.5	47.2	20.6	4.7	--	--	--	--	--	--	--
	18	76.0	17.3	13.8	0.4	3.1	1094	756	86	252	131	130	57	- 56	72.5	43.5	8.0	21.0	10.65	2.50	6.75	7.82	4.14	3.68	4.91
	19	76.0	17.3	14.0	1.5	1.8	1094	788	338	- 32	131	142	194	-205	72.5	42.8	16.6	13.1	--	--	--	--	--	--	--
	20	76.1	17.3	14.2	1.5	1.6	1094	822	355	- 83	131	169	200	-238	72.5	51.0	21.0	0.5	--	--	--	--	--	--	--

All periods 5 days in length. All balances are positive unless marked negative (-).

Subject C = J. D. Subject D = A. He.

*Bodansky Units.

concurrent shifts in phosphorus intake make any such analysis impossible.

Potassium Balance.—All 5 subjects demonstrated marked and prolonged retention of potassium. In subjects A.A., G.S., and A. He., this retention gradually decreased (from approximately 20 mEq./day at the beginning of the experiment to 0.5 to 12 mEq./day at the end). In subjects T.B. and J.D. the magnitude of the potassium retention remained about the same (J.D.: about 14 mEq./day; T.B.: 12 mEq./day). In all 5 individuals the pattern of the potassium retention followed rather closely the pattern of the nitrogen retention. Alterations in calcium intake did not seem to alter the extent of the potassium retention.

Calcium Balance.—The mean calcium balances are summarized in table 10. Although there were individual differences in the pattern of the calcium balances throughout the study, certain of the observations were common to all of the subjects: (a) at the low levels of intake (107 and 132 mg./day) all patients were consistently in negative balance; (b) at

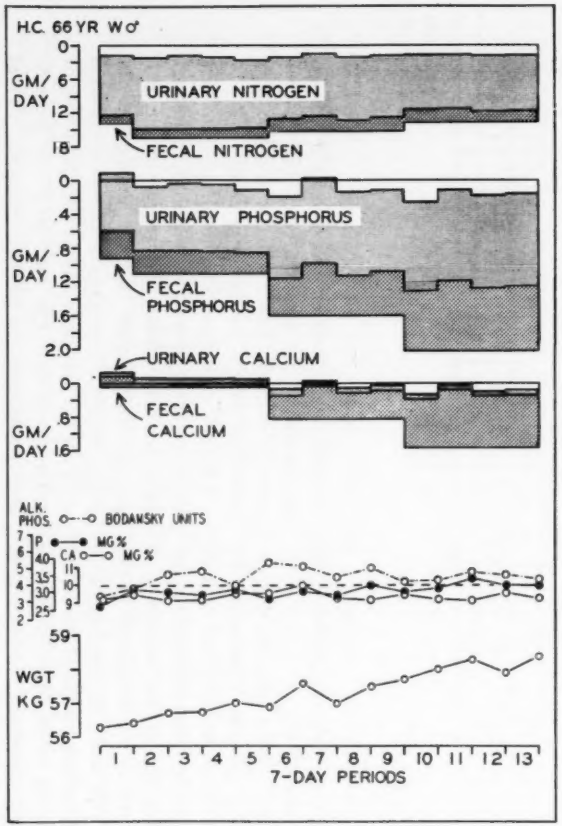


FIG. 1. Study I. Subject H. C. Age 66. Effect of alterations in Ca intake on N, P, Ca balances, body weight, and serum levels of alkaline phosphatase, P and Ca. The balance charts in all figures are plotted in the following manner: Intake is plotted downward from the zero line, fecal excretion is plotted upward from the intake line, and urinary excretion is plotted upward from the fecal output level. Thus, a hatched area above the zero line represents a negative balance and a clear area below the zero

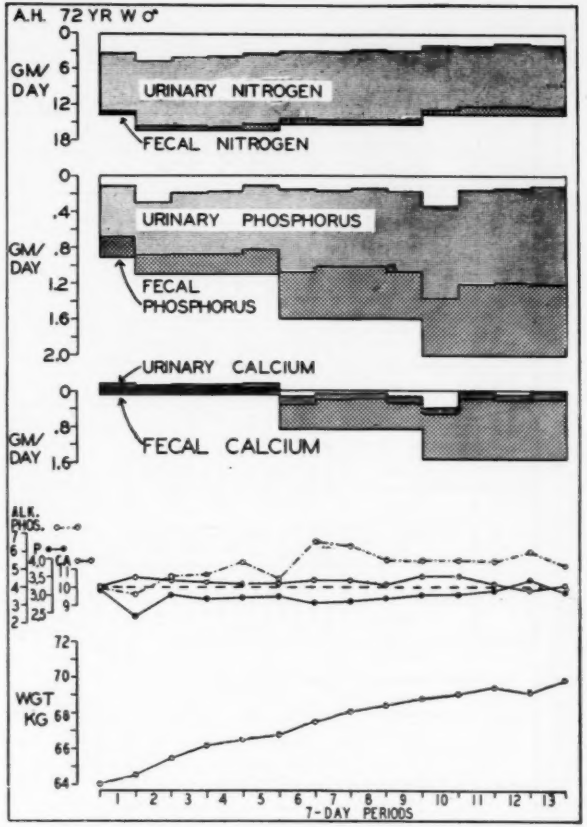
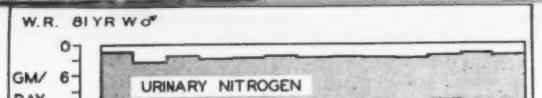


FIG. 2. Study I. Subject A. He. Age 72. Effect of alterations in Ca intake on N, P, Ca balances, body weight, and serum levels of alkaline phosphatase, P and Ca. Note the gradually decreasing storage of nitrogen throughout the study.



from the intake line, and urinary excretion is plotted upward from the fecal output level. Thus, a hatched area above the zero line represents a negative balance and a clear area below the zero

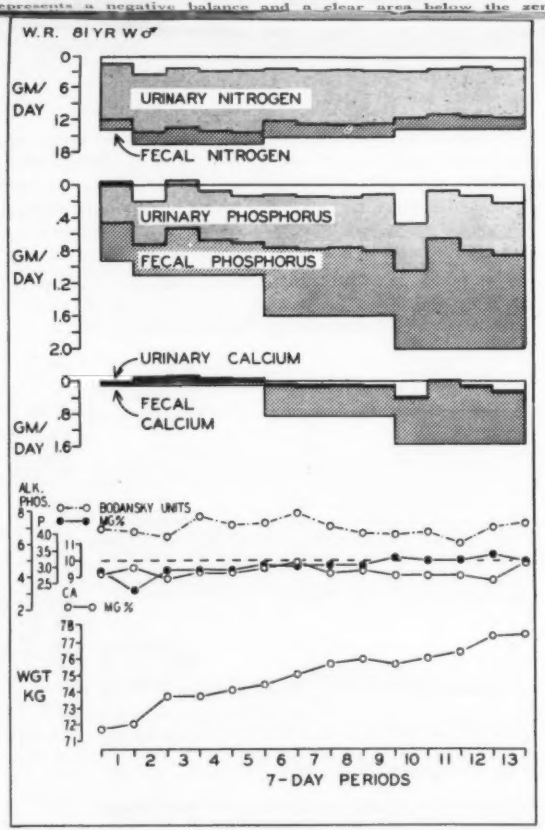


FIG. 3. Study I. Subject W. Ra. Age 81. Effect of alterations in Ca intake on N, P, Ca balances, body weight, and serum levels of alkaline phosphatase, P and Ca. This subject was in positive nitrogen balance throughout the study and stored calcium at high intake levels (periods 10-13). The elevated serum alkaline phosphatase is unexplained. This patient had x-ray evidence of osteoporosis.

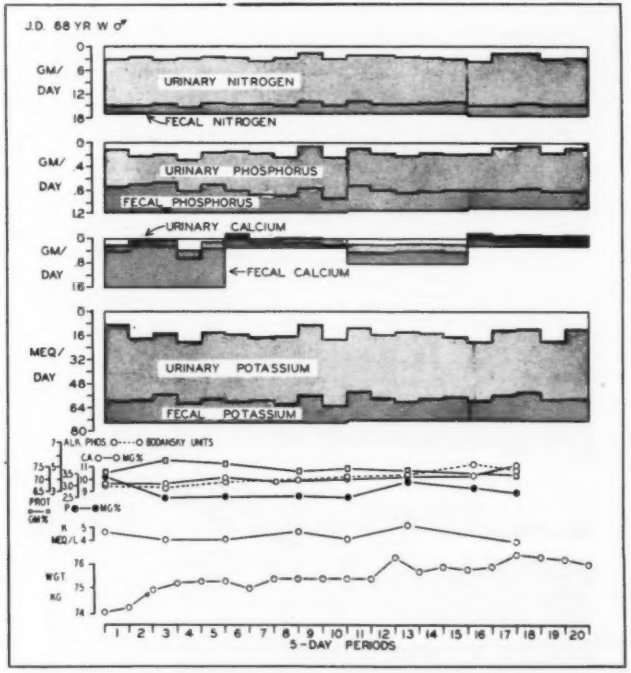


FIG. 4. Study II. Subject J .D. Age 68. Effect of alterations in Ca intake on N, P, Ca balances, body weight, and serum levels of alkaline phosphatase, P and Ca.

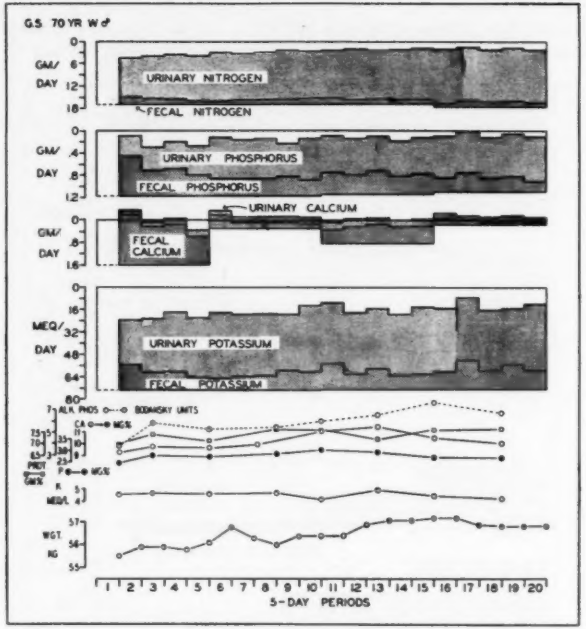


FIG. 5. Study II. Subject G. S. Age 70. Effect of alterations in Ca intake on N, P, Ca balances, body weight, and serum levels of alkaline phosphatase, P and Ca. Note the prolonged, gradually decreasing retentions of nitrogen, phosphorus, and potassium. Calcium storage occurred only in period 5 at high calcium intake levels. This patient showed x-ray evidence of osteoporosis.

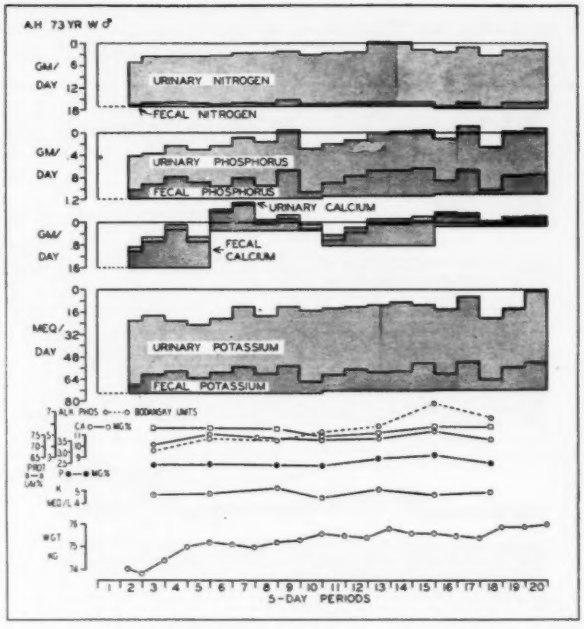


FIG. 6. Study II. Subject A. He. Age 73. Effect of alterations in Ca intake on N, P, Ca balances, body weight, and serum levels of alkaline phosphatase, P and Ca. Note the gradually decreasing retentions of nitrogen, phosphorus, and potassium. Of particular interest is the marked calcium storage during periods 2-5 followed by losses during period 6-7, when the calcium intake was markedly reduced.

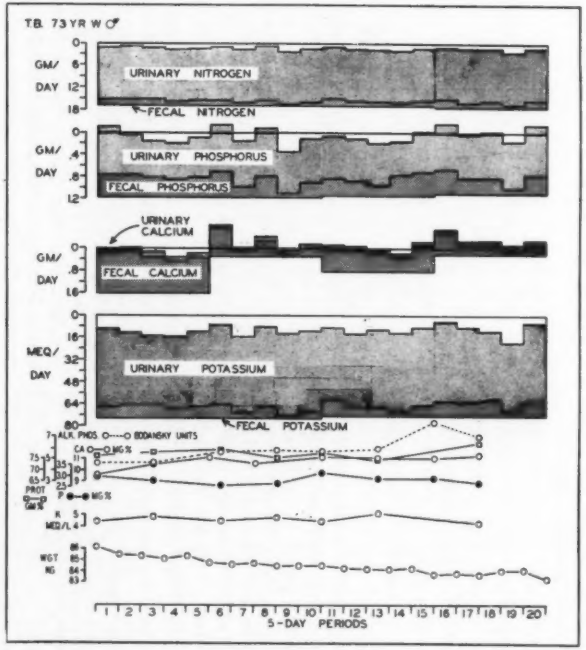


FIG. 7. Study II. Subject T. B. Age 73. Effect of alterations in Ca intake on N, P, Ca balances, body weight, and serum levels of alkaline phosphatase, P and Ca. This is the one patient who lost weight during the study.

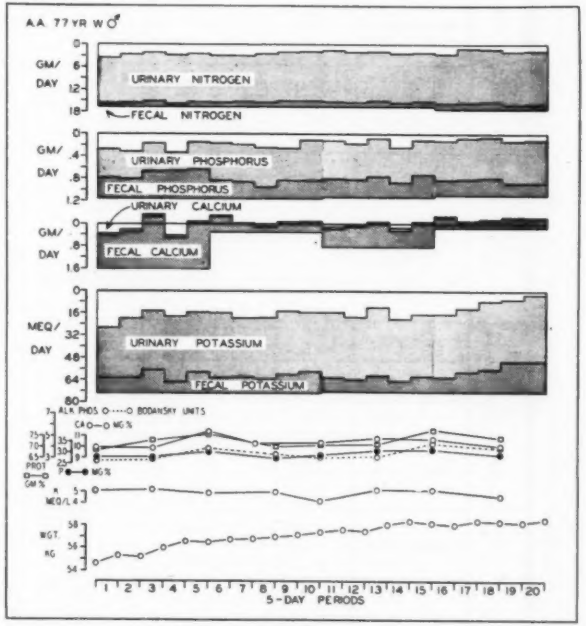


FIG. 8. Study II. Subject A. A. Age 77. Effect of alterations in Ca intake on N, P, Ca balances, body weight, and serum levels of alkaline phosphatase, P and Ca. Note the initial retention of potassium which decreased markedly during the study.

TABLE 9. METABOLIC DATA ON SUBJECTS -- STUDY II (March 13 - June 20)

	Period	Wgt. of Patient (kg.)	Nitrogen (Gm./day)				Phosphorous (mg./day)				Calcium (mg./day)				Potassium (mEq./day)				Serum						
			Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Intake	Urine	Stool	Balance	Calcium (mg. %)	Phosphorous (mg. %)	Alkaline Phosphatase*	Total Protein (Gm. %)	Albumin (Gm. %)	Globulin (Gm. %)	Potassium (mEq./Liter)
E	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	2	55.9	16.8	10.4	2.0	4.4	1162	361	716	85	1598	205	1784	-391	73.9	32.3	18.2	23.4	9.35	2.45	3.88	6.98	4.24	2.74	4.50
	3	55.9	16.8	11.4	1.6	3.8	1165	424	460	281	1602	222	1341	39	74.0	38.3	13.2	22.5	9.88	2.75	5.94	7.46	4.49	2.97	4.64
	4	55.8	16.8	11.9	1.5	3.4	1165	489	480	196	1602	228	1457	- 83	74.0	42.9	13.6	17.5	--	--	--	--	--	--	--
	5	56.1	16.8	12.1	1.0	3.7	1165	530	368	267	1602	215	1059	328	74.0	42.9	9.3	21.8	--	--	--	--	--	--	--
	6	56.8	16.8	13.1	0.9	2.8	1165	736	314	115	292	162	462	-332	74.0	47.2	9.0	17.8	9.75	2.72	5.32	7.33	4.19	3.14	4.59
	7	56.3	16.8	12.4	1.2	3.2	1165	688	312	165	292	198	212	-118	74.0	44.0	11.0	19.0	--	--	--	--	--	--	--
	8	56.0	16.8	12.7	1.2	2.9	1165	712	312	141	292	219	214	-141	74.0	44.2	11.3	18.5	10.00	--	--	--	--	--	4.66
	9	56.4	16.8	13.0	1.5	2.3	1165	586	346	233	292	219	219	-146	74.0	41.4	13.9	18.7	--	2.82	5.50	7.71	4.66	3.05	--
	10	56.4	16.8	13.0	1.3	2.5	1165	742	287	136	292	208	184	-100	74.0	46.9	14.6	12.5	--	--	--	--	--	--	--
	11	56.4	16.7	12.8	1.7	2.2	1132	646	400	86	818	270	507	41	72.2	43.3	18.5	10.4	11.22	3.01	6.01	7.40	4.30	3.10	4.06
	12	56.9	16.7	13.5	1.3	1.9	1132	636	366	130	818	255	612	- 49	72.2	42.6	11.7	17.9	--	--	--	--	--	--	--
	13	57.1	16.7	12.8	1.6	2.3	1132	629	413	90	818	227	684	- 93	72.2	42.5	15.0	14.7	11.60	2.90	6.59	7.24	4.25	2.99	4.88
	14	57.1	16.7	13.3	1.2	2.2	1132	642	317	173	818	230	559	29	72.2	42.5	10.6	19.1	--	--	--	--	--	--	--
	15	57.2	16.7	13.7	1.4	1.6	1132	658	368	106	818	246	624	- 52	72.2	47.5	11.1	13.6	--	--	--	--	--	--	--
	16	57.2	17.3	14.3	1.0	2.0	1094	733	265	96	132	162	241	-271	71.8	45.0	12.3	14.5	10.52	2.72	7.70	7.64	4.43	3.21	4.41
	17	56.9	17.3	14.3	1.6	1.4	1094	745	345	4	132	169	143	-180	71.8	43.4	21.3	7.1	--	--	--	--	--	--	--
	18	56.8	17.3	14.0	1.2	2.1	1094	742	238	114	132	183	86	-137	71.8	41.4	14.4	16.0	10.05	2.73	6.78	7.43	4.09	3.34	4.14
	19	56.8	17.3	14.2	1.5	1.6	1094	770	284	40	132	201	104	-173	71.8	38.7	18.2	14.9	--	--	--	--	--	--	--
	20	56.8	17.3	14.0	1.1	2.2	1094	782	217	95	132	182	69	-119	71.8	47.1	13.0	11.7	--	--	--	--	--	--	--

All periods 5 days in length All balances are positive unless marked negative (-).

Subject E = G.S.

*Bodansky Units.

the intermediate levels of intake (292, 816 and 859 mg./day), balances tended to attain equilibrium; (c) at the highest levels of intake (1543 and 1600 mg./day) varying degrees of positive balance were effected. This information is summarized in table 9[5]; (d) urinary excretion was greater at the higher levels of intake than at the lower levels. Tables 5 to 8 and figure 9 illustrate this pattern.

Individual differences included the following:

Subject A. He.: This patient was observed during both studies. During the first study, although the patient shifted from negative (mean = -99 mg./day) to positive (mean = +79 mg./day) balance when the intake was increased from 107 mg./day (periods 1 to 5) to 859 mg./day (periods 6 to 9), when the intake was increased further (1543 mg./day, periods 10 to 13), the mean positive balance decreased slightly (+58 mg./day). During the second study, a greater net loss at a higher intake occurred; at an intake of 131 mg./day (periods 16 to 20) the mean balance was -212 mg./day whereas at an intake of 292 mg./day (periods 6 to 10) the mean balance was -252 mg./day. At the intake level of 1600 mg./day (periods 2 to 5) the patient stored a considerable amount of calcium, (mean balance +367 mg./day).

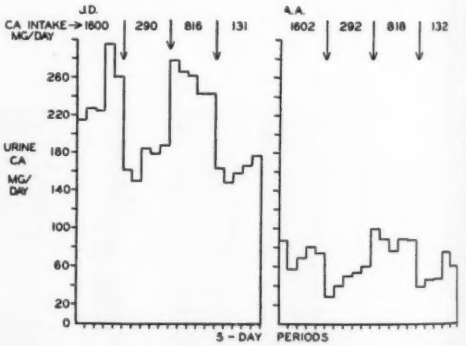


FIG. 9. Changes in urinary calcium occurring with changes in calcium intake in an individual with a high urinary calcium (J. D.) and in an individual with a low urinary calcium (A. A.).

[5] Mean balances are expressed for the last 3 periods at the different intake levels for the first study, and for the last 4 periods at the individual intake levels for the second study. The rationale for this analysis of the data was to allow for some summary statement of the balances at the individual intake levels, but not to include the possible error of a balance expression that occurs immediately following a change in intake levels. Examples of such balance disparities, probably inherent in the method of stool demarcation, are periods 9 and 10 in H.C. and W. Ra. and periods 5, 6, 15, and 16 in T.B. and G.S.

TABLE 10. MEAN CALCIUM BALANCES (mg./DAY)

STUDY I. Average of Last 3 Periods

Intake	H. C.	W. Ra	A. He
107	-108	- 93	-99
859	59	81	79
1543	135	104	58

STUDY II. Average of Last 4 Periods

Intake	A. A.	T. B.	J. D.	A. He	G. S.
131	-180	-226	-123	-212	-152
292	- 32	- 94	- 11	-252	-126
816	- 2	- 20	180	- 75	- 41
1600	42	138	126	367	150

All balances are positive unless marked negative (-).

Serum Values.—There were no significant changes in the values of serum calcium, phosphorus, protein, or potassium for any of the patients. The initial serum alkaline phosphatase values were between 3 and 5 Bodansky units in all subjects except W. Ra., who had a value of 6.9. All subjects showed a rise during the course of the study with values as high as 4 to 8 Bodansky units.

Discussion

The characteristics of calcium metabolism in these 7 elderly male subjects varied to some extent from patient to patient. The nature of the balances, however, at the very low intake of calcium (107 and 132 mg./day) is the same for all patients, namely, a consistent negative balance of about 100 to 200 mg./day. This obligatory loss of calcium—composed of the urinary loss of unreabsorbed calcium of the glomerular filtrate and the fecal loss dependent upon unreabsorbed calcium in the gastro-intestinal tract (calcium presented into the gastro-intestinal lumen either by ingestion or in the biliary and pancreatic secretions) is of the same magnitude as that observed for younger adults (2). A relationship between the renal excretion of calcium and that by way of the gastrointestinal tract is suggested by the observations made on subjects W. Ra. and A.A. Both these individuals excreted relatively small amounts of calcium in the urine and relatively large amounts of calcium in the feces, the mean negative balances falling close to the mean total losses for the other patients who excreted larger amounts of urinary calcium. The calcium excreted in the urine rose and fell with corresponding changes in the intake level (tables 5 to 8, figure 9).

This may be taken as evidence that at higher intake levels more of the calcium was removed from the gut and transported to the kidney for excretion by that route. The associated increase in serum calcium could lie within the experimental error of methods for determining serum calcium.

In considering the calcium requirement of an individual, the data of a balance study may be interpreted from two points of view. From one point of view, the retention of large amounts of calcium may be interpreted as evidence of need and therefore a large "requirement" (15). This concept of "requirement" includes the storage of calcium. From the other point of view the requirement is described by the amount of calcium required to maintain equilibrium (14, 17). Thus A. He. stored the largest amount of calcium at high intake levels (1600 mg./day) but could maintain calcium equilibrium at an intake of ap-

proximately 850 mg./day. For each of the other subjects as well, an intake of approximately 850 mg./day (subject J.D., perhaps somewhat below 800 mg./day) was adequate to effect calcium equilibrium. This figure is close to the 1.0 Gm./day intake for young adults recommended by the Food and Nutrition Board of the National Research Council (16). Hegsted and associates (9) have reported calcium equilibrium on intake levels of 150 mg./day (range 0 to 596 mg.) in 10 male subjects (age 30 to 56). Since their subjects were prisoners who had presumably been on low calcium intakes for a number of years, the authors conclude that the amount of calcium required to maintain equilibrium is influenced primarily by the prior intake level of the subject.

It should be noted that failure to store calcium may be present in the face of a calcium deficit, if the mechanisms for calcium storage are impaired. Osteoporosis is considered to be an example of this situation (21, 23, 25). Two of our cases, subjects G.S. and W. Ra., had x-ray evidence of osteoporosis and showed only slight storage of calcium at high levels of intake.

The observations upon these subjects may or may not be in accord with the present concept that osteoporosis in the aged is primarily a defect in the ability to form protein matrix in the bone upon which the calcium salts are then deposited. The data on nitrogen and phosphorus balance do suggest that these patients are able to build protoplasm. The failure to store calcium in the presence of this general state of anabolism may indicate either a defect in bone matrix construction or failure to incorporate calcium salts into the matrix.

In order to provide optimal conditions for calcium retention, the protein intake in these experiments was set at a relatively high level. Since the extra protein of the diet was largely meat, the intake of phosphorus was also high. Thus it is possible to examine the data for the effects of prolonged administration of diets high in nitrogen and phosphorus.

Examination of the data indicates a retention of nitrogen in all subjects tested during the entire course of the experiment. In view of the potential errors of balance studies, all of which tend to produce positive nitrogen balances, we cannot be certain of the magnitude of the total nitrogen retention. However, it may be pointed out that in all but one subject (T.B.) the magnitude of the positive nitrogen balance gradually diminished during the course of the study. Even if we assume that all subjects were in true nitrogen balance at the end of the study, it is apparent that there was a significant retention of nitrogen during the period of high protein intake. The average "theoretical" weight gain, calculated on the basis of the adjusted nitrogen balance (2.2 Kg.) was in accord with the observed changes in weight (average 2.3 Kg.). Weight gains occurred in all subjects except T.B., whose adjusted nitrogen balance was slightly negative. Furthermore, the average ratio of the adjusted nitrogen retention to the similarly adjusted average phosphorus retention was close to the "theoretical values."[6] In addition the average adjusted potassium balances were in accord with values expected, assuming the nitrogen retention was associated with the formation of tissue.[7] It is therefore presumed that these aged males were building body protoplasm during the course of the study.

Summary

1. The magnitude of the negative balance of calcium at low levels of intake is neither greater nor less than the magnitude of calcium loss of young adults at similar low levels of intake.

2. In aged males, approximately 850 mg. of calcium per day is adequate to effect calcium equilibrium.

3. Aged male individuals retain the ability to

[6] The average phosphorus retention required for the entire study calculated on the basis of observed calcium retention and adjusted nitrogen retention was 6.3 Gm. as compared with the actual adjusted phosphorus retention of 6.9 Gm.

[7] The average adjusted nitrogen retention for the 5 subjects for whom potassium retentions were available was 57 Gm. for the entire study. The expected average potassium retention for these subjects was 153 mEq. The average observed (adjusted) potassium retention was 152 mEq. for these 5 subjects.

store nitrogen-phosphorus and potassium and thereby to build protoplasm.

4. When large amounts of calcium are supplied to aged male individuals with x-ray evidence of osteoporosis and who are concurrently storing nitrogen, retention of calcium is not strikingly increased, thereby suggesting either (a) a defect in the mechanism of building bone matrix (bone protoplasm) or (b) a defect in the ability to incorporate calcium salts upon the protoplasmic matrix.

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We wish to acknowledge our indebtedness to Esther Rosenberg, Ruth Kennedy, and Mae Griffin for the preparation and serving of the food, and to Mary Jane Ford, John Melvin, Millard Starnes, Margaret Bellistri, and Janis Parsons for technical assistance. Dr. Milton Landowne offered valuable criticism and suggestions in interpretation of the results. Thanks are also due Mrs. Elizabeth Strawn for supervision of the special nursing required in this study.

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Submitted for publication May 20, 1953

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Calcium and Phosphorus Balance in Elderly Men

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Because of the frequency of osteoporotic lesions in the aged, the subject of the calcium and phosphorus requirements of old individuals constitutes an important gerontologic problem. In extensive animal experiments, Kane and McCay (4) found that old female rats and hamsters were in negative calcium balance when fed a diet that was adequate to maintain equilibrium or positive balance in younger animals, and more recently McCay (9) has indicated that the tendency for the development of negative calcium balance in aged animals is greater in males than in females.

The data in the literature concerning the calcium requirements of adult humans likewise suggest that a higher calcium intake is required for the establishment of calcium equilibrium in old subjects than in younger persons. Investigations with regard to phosphorous requirements by individuals in the various age groups are as yet rather incomplete.

Outhouse and collaborators (2, 13) studied 4 young women and 3 young men and found that the average daily intake of calcium necessary for the establishment of equilibrium was 10.7 mg./Kg. Mitchell and Curzon (11) in similar investigations arrived at a value of 9.7 mg./Kg. for young adults. Steggerda and Mitchell (21) studied the calcium requirements of 19 young men. They found the average daily intake for equilibrium to be 9.2 mg./Kg. Reviewing the above cited results and including some unpublished data which showed an equilibrium intake of 11.6 mg./Kg., they concluded that the mean daily intake for equilibrium in young adults was close to 10 mg./Kg. These authors also studied extensively (20) the calcium balance in 1 man 35 years of age and found his requirements for equilibrium to be 8.6 mg./Kg. Later studies by these same authors (22) on young adults led to a value of 7.4 mg./Kg. In these later investigations the nitrogen balance was not determined, but all the subjects were stated to be receiving a diet adequate in calories, protein, and vitamins.

Kunerth and Pittman (7) studied 3 young women. Their subjects were in negative calcium balance on an intake of from 8.6 to 9.1 mg./Kg./day. They were in slight positive nitrogen balance on an intake of 0.5 Gm. of protein per Kg./day. Their phosphorus intake varied between 17.3 and 18.9 m./Kg./day, on which intake they were in equilibrium or slight negative balance. Pittman and Kunerth (17) later studied the same 3 subjects and 1 additional young woman on a higher protein intake of 1.2 Gm./Kg./day. All the subjects were in highly positive nitrogen balance, but were still in negative calcium balance on a calcium intake of 8.3 mg./Kg./day. The calcium deficit, however, was less than on the lower protein diet. Their phosphorus balance was slightly positive on an intake of 17.6 mg./Kg./day.

McKay and collaborators (10) studied 124 young college women. For these subjects the equilibrium intakes may be estimated from the authors' regression curve to be 810 mg. of calcium, 1010 mg. of phosphorus, and 54.5 Gm. of protein per day. The data are not expressed in terms of requirements per kilogram of body weight, but it is probable that their average weight did not exceed 65 Kg., and hence the minimum requirements would be 12.5 mg./Kg. for calcium and 15.6 mg./Kg. for phosphorus. Leichsenring, Norris, and Lamison (8) studied the calcium and phosphorus balances in young college women. Their subjects were all in negative calcium balance on an intake of 300 mg./day and in positive balance on an intake of 1500 mg./day. On the higher calcium intake the subjects were in approximate phosphorus equilibrium on an intake of 800 mg. of phosphorus per day. The addition of 600 mg. more phosphorus per day increased the phosphorus balance so that the subjects were then all in positive phosphorus balance and slightly lowered the calcium balance so that the subjects were now close to equilibrium.

Patton and Sutton (16) studied 9 young

women on an intake of 747 mg. of calcium per day, 400 mg. of which were derived from different calcium salts used as supplements. The diet contained 57 Gm. of protein and 758 mg. of phosphorus. They observed no difference in the utilization of the different calcium salts and found that on the calcium intake of 747 mg./day there were a slightly greater number of periods of positive than of negative balance.

Hegsted, Moscoso, and Collazos (3) studied the calcium requirements of 10 adult men in a Lima, Peru, prison. The ages of their subjects varied from 30 to 56 years. The intake was varied from 200 to 700 mg. of calcium per day. These authors concluded that the intake requirement for equilibrium was approximately 200 mg./day or 3.3 mg./Kg./day. Owen (14) studied 10 men ranging in age from 32 to 69 years. He found his subjects to be in equilibrium on intakes of 520 mg. of calcium and 1200 mg. of phosphorus per day on a diet containing 58 Gm. of protein per day. Owen, Irving, and Lyall (15) studied 7 elderly men, several of whom presented evidences of senile osteoporosis. They found that on an intake of 250 mg. of calcium, 580 mg. of phosphorus, and 50 Gm. of protein per day, the subjects lost only small amounts of calcium or phosphorus, 100 mg. per day at the most.

Bogdonoff, Nicholas, and Shock (1) studied 3 elderly males on varying calcium intakes. The subjects were all in negative calcium balance on intakes of 107 mg./day and in positive balance on 849 mg./day. The protein intake varied between 84 and 100 Gm. per day and the phosphorus intake between 927 and 1931 mg. per day. The subjects were all in positive nitrogen and phosphorus balance throughout.

Roberts, Kerr, and Ohlson (19) studied 9 active elderly women between the ages of 52 and 74 years. They computed that the average intakes required for equilibrium in these subjects were 0.88 Gm. of protein / Kg./day, and 14.1 mg./Kg./day of calcium.

On the basis of the publications cited above (2, 7, 8, 10, 11, 13, 16, 17, 19, 20, 21, 22) it would seem that the calcium intake required for equilibrium in young adults lies between 8 and 12 mg./Kg./day and is probably close to 10 mg./Kg. The values reported for elderly individuals are as yet too few and not in sufficient agreement to permit more precise conclusions with regard to necessary calcium intake. According to the investigations referred to above, the phosphorus intake required for balance is about 15-17 mg./Kg./day for young adults. For older female subjects the need for a slightly higher intake (at least 20 mg./Kg./day) has been suggested.

The present study was undertaken with the purpose of supplying additional data concerning the magnitude of the calcium and phosphorus intake required for the establishment of equilibrium in elderly individuals.

Material and Methods

The subjects included in the study were 8 elderly men, who were inmates of the St. Louis City Infirmary Hospital. Their mean age was 77 years. They had all been on a dietary regimen for some time prior to the beginning of the present study. They were well adjusted to the basic diet and completely habituated to the procedures used for the collection of urine and stool specimens. None of the patients suffered from acute or chronic infectious diseases, malignant lesions, or organic gastrointestinal disease. They were all ambulatory throughout the study. A brief review of the clinical status is given below.

No. 1 (De) Age 88 years, weight 55 Kg., height 168 cm. Had been a patient of the Infirmary Hospital since 1947. The examination revealed the presence of arteriosclerotic heart disease with evidence of slight cardiac decompensation. X-rays showed no evidence of osteoporosis. Serum calcium was 10.3 mg.%; serum phosphorus, 3.2 mg.%. The blood pressure was 150/80, basal metabolic rate, −13%. Other laboratory data: red cells, 4.1 million; hemoglobin, 10.5 Gm.; white cells, 7,300; differential, within normal limits; N.P.N., 35 mg.%; fasting blood sugar, 80 mg.%; Kahn test, negative; urinalysis, negative for sugar and protein.

No. 2 (Ad) Age 81 years, weight 52.5 Kg., height 164 cm. Had been a patient at the Infirmary Hospital since 1948 with symptoms of cerebral arteriosclerosis.

X-ray examination showed no evidence of osteoporosis. Serum calcium was 10.2 mg.%; serum phosphorus, 3.6 mg.%. The blood pressure was 110/70, basal metabolic rate, +14. Other laboratory data: red cells, 3.7 million; hemoglobin, 10.9 Gm.; white cells, 6,800; differential, within normal limits; N.P.N., 33 mg.%; fasting blood sugar 80 mg.%; Kahn test, negative; urinalysis, negative for sugar and protein.

No. 3 (Mc) Age 76 years, weight 62 Kg., height 171 cm. Was admitted to Infirmary Hospital ten years prior to present study following injury in accident. Has had occasional attacks of epilepsy since accident. The physical examination revealed the presence of arterial hypertension (blood pressure 180/80) and moderate cardiac enlargement. X-rays revealed no evidence of osteoporosis. The serum calcium was 10.3 mg.%; serum phosphorus, 3.4 mg.%. The basal metabolic rate was −11%. Other laboratory data: red cells 4.5 million; hemoglobin, 12.8 Gm.; white cells, 8,600; differential within normal limits; N.P.N, 21 mg.%; fasting blood sugar, 73 mg.%; Kahn test, negative; urinalysis, negative for sugar and protein.

No. 4 (Ki) Age 72 years, weight, 47 Kg., height, 162 cm. Had suffered from bronchial asthma since childhood and at age of 30 was treated for syphilis. He had been a patient at the Infirmary Hospital following the fracture of a leg in 1947. The physical examination revealed marked emphysema of the lungs with enlargement of the chest in the antero-posterior diameter. There were no ronchi or rales. X-ray examination showed no definite evidence of osteoporosis. The serum calcium was 10.4 mg.%; serum phosphorus, 2.9 mg.%. The blood pressure was 156/95, the basal metabolic rate was −32. Other laboratory data: red cells, 4.5 million; hemoglobin, 14.4 Gm.; white cells, 12,300; differential within normal limits; N.P.N., 27 mg.%; fasting blood sugar, 89 mg.%; Kahn tests of blood and spinal fluid were negative; urinalysis, negative for sugar and protein.

No. 5 (Ko) Age 69 years, weight, 66.5 Kg., height, 161 cm. Had been a patient at the Infirmary Hospital since 1945 because of mild depression and psychiatric symptoms. The physical examination showed no abnormal findings apart from moderate hypertension. X-ray studies revealed no evidence of osteoporosis. The serum calcium was 10.3 mg.%; serum phosphorus, 3.5 mg.%. The blood pressure was 175/85, basal metabolic rate was −8%. Other laboratory data: red cells, 4.5 million; hemoglobin, 15.4 Gm.; white cells; 10,300; differential within normal limits; N.P.N., 20 mg.%; fasting blood sugar, 76 mg.%; Kahn test negative; urinalysis negative for sugar and protein.

No. 6 (Ta) Age 75 years, weight, 60.5 Kg., height, 165 cm. In 1943 had left supracondylar amputation performed because of gangrene of left foot. Has since had episodes with signs of cerebral thrombosis. The physical examination performed in connection with the present study revealed nothing significantly abnormal apart from absence of lower left leg. Subject was able to walk with aid of crutches. X-ray examination revealed no definite evidence of osteoporosis. The serum calcium was 10.4 mg.%; serum phosphorus, 3.2 mg.%. The blood pressure was 150/90, basal metabolic rate, −12%. Other laboratory data: red cells, 4.9 million; hemoglobin, 13.7 Gm.; white cells, 7,800; differential within normal limits; N.P.N., 27 mg.%; fasting blood sugar, 89 mg.%; Kahn test negative; urinalysis negative for sugar and protein.

No. 7 (Os) Age 70 years, weight 41 Kg., height 162 cm. Had been a patient at the Infirmary Hospital since 1946 with symptoms of moderate cerebral arteriosclerosis. Apart from underweight, physical examination revealed nothing of significance. X-ray examination showed only questionable evidence of osteoporosis. The serum calcium was 9.7 mg.%; serum phosphorus, 2.8 mg.%. The blood pressure was 118/80, the basal metabolic rate was −4%. Other laboratory data: red cells, 4.9 million; hemoglobin, 9.5 Gm.; white cells, 8,500; differential within normal limits; N.P.N., 35 mg.%; fasting blood sugar, 64 mg.%; Kahn test negative; urinalysis negative for sugar and protein.

No. 8 (Ma) Age 74 years, weight 62 Kg., height 168 cm. The subject has been hospitalized since 1946 at which time he had suffered a cerebral hemorrhage Had improved noticeably since then. Physical examination revealed slight residual paralysis of the muscles of the face and the extremities of the right side. The heart was enlarged to the left and there was slight pitting edema of the lower legs. X-ray examination showed slight osteoporosis of the pelvic bones. The serum calcium was 9.9 mg.%; serum phosphorus, 3.0 mg.%; serum alkaline phosphatase, 1.7 Bodansky units. The blood pressure was 130/70, the basal metabolic rate was −17%. Other laboratory data: red cells, 4.4 million; hemoglobin, 9.5 Gm.; white cells, 6,200; differential within normal limits; N.P.N., 27 mg.%; fasting blood sugar, 68 mg.%; Kahn test negative; urinalysis negative for sugar and protein.

Methods—Food Preparation and Sampling of Food, Urine, and Stool

The methods used were the same as in our previous studies on nitrogen balance (6) but the pertinent details will be briefly reviewed here. A series of 7 well-balanced menus was made up, one for each day of the week. These menus contained green vegetables, meat, eggs, and milk in addition to other staple food stuffs and were considered by us and by the subjects

to be superior to the regular hospital diet. Swift's Junior Meats were used for all meat servings, giving preparations which were not only more homogeneous, but were readily eaten even by the edentulous subjects. All servings given the subjects were weighed (except liquids such as milk and fruit juice which were measured by volume) and at the same time 3 additional servings were weighed out and reserved for analysis. These additional servings were pooled in 3 separate containers giving at the end of the day 3 samples each equivalent to all the food measured out during the day. Each total sample was homogenized in a Waring Blendor and treated with sufficient sulfuric acid to give a homogeneous mixture. This was diluted to a definite volume and aliquots taken for analysis.

Any food weighed out to, but not eaten by the subject was reserved for analysis. In some instances, in order to regulate the protein intake at the proper level, some of the food weighed out to the subject was withheld and not offered to him. This food was treated as left-over food for the subject. The left-over foods were pooled for five day periods for analysis. In order to adjust the protein intake to the desired level, the subjects received varying amounts of milk in addition to the basic diet. Additional milk was also given to compensate for the protein in the food left by the subject. The milk portions were all accurately measured by volume and the amounts recorded. This milk was not added to the basic diet for analysis, but aliquots of the milks were analyzed separately. The left-over foods were treated in the same manner as the total food samples.

The drinking water contained small amounts of calcium. An estimate was made of the amount ingested other than with the meals. The additional calcium taken in this way was not more than 10 mg. per day except for one subject (No. 3, Mc) whose water intake was sometimes as high as 3 L. per day.

The subjects were under continuous observation to insure complete collection of urine and stool specimens. Large sample bottles containing dilute sulfuric acid as a preservative were available adjacent to the metabolism ward where the urine samples were placed as soon as collected. These bottles were sent to the laboratory every morning, where the total volume was recorded, a sample taken for creatinine analysis, and the urine pooled for five day periods for analysis. The stool specimens were also collected in bottles containing dilute acid and sent to the laboratory each day. They were pooled for five day periods, homogenized, and treated with sulfuric acid similar to the food samples. Although every effort was made to collect the stool and urine specimens separately, there was occasionally some mixture of stool and urine. Since both were analyzed the mixing would not effect the over-all balance, but would effect the proportion of calcium and phosphorus found in the urine and stool.

Methods—Chemical Analysis

Separate aliquots for calcium and phosphorus determinations were subjected to wet ashing with sulfuric, nitric, and perchloric acids. The phosphorus was determined by the colorimetric method of the Association of Official Agricultural Chemists (12). In the wet ashing of both the calcium and phosphorus samples the general procedures outlined for the phosphorus method was followed. The calcium was determined by permanganate titration of the precipitated calcium oxalate. After wet ashing, most of the excess sulfuric acid was driven off by strong heating. The sample was transferred quantitatively to a beaker and the calcium precipitated by the addition of oxalic acid and ammonia to the full alkaline color of bromphenol blue. The solution was allowed to stand overnight at room temperature and the supernatant removed through a prepared filter stick. The precipitate was washed with 3 per cent ammonium hydroxide, 3 times with a saturated solution of calcium oxalate, and again with ammonia. The precipitate was dissolved in hot 10 per cent sulfuric acid containing 2 per cent manganous sulfate and titrated while hot with standard permanganate. Preliminary ex-

periments showed that under the conditions finally adopted, calcium could be quantitatively recovered and that amounts of magnesium known to be present in foods did not interfere. Nitrogen was determined by a modification of the Kjeldahl method (6).

Results

The results of the simultaneously performed calcium, phosphorus, and nitrogen balance studies in the 8 elderly men are shown in figures 1 to 4. The calcium and phosphorus values are expressed in milligrams per day, the nitrogen values in grams per day. The data are presented according to the method suggested by Reifenstein, Albright, and Wells (18), in which the intake is plotted downward from the base line. The output is then plotted upward from the lower intake line. The urinary output is represented by the upper hatched portion and the fecal output by the lower shaded portion of the column. In this method a clear space between the top of the output column and the base line represents a positive balance, and the extension of this column above the base line represents a negative balance. It will be noted that with the exception of the one subject (Ki) at the beginning of the study, all of the subjects were in positive nitrogen balance throughout the entire period. Where only one level of nitrogen intake is shown on the figure it represents an intake of 1 Gm. of protein per kilogram of body weight per day. In those instances in which two levels of protein intake are represented (subjects Ad, Os, Ma and Ki) the lower level is 1.0 Gm. of protein per kilogram per day and the higher level 1.5 Gm.

The calcium and phosphorus balances as calculated over longer periods (30 to 70 days) are presented in table 1. The periods used are shown by the arrows in figures 1 to 4. It will be seen from this table and figure 4 that 1 of the 8 subjects, Ma, had an abnormal calcium balance. On a calcium intake of 1100 mg. per day this subject excreted approximately twice that amount, which resulted in a negative balance of about 1000 mg./day. On an intake of 2000 mg. per day the balance was still found to be negative by an amount of approximately 500 mg. per day. This subject was the only one of the 8 individuals who received calcium in any other form than that contained in the regular foods. The additional calcium was given as calcium gluconate as indicated in figure 4. In figures 5 and 6 the calcium and phosphorus balances are plotted against the intakes both expressed as mg./Kg./day. As indicated in table 1, the data for the subject Ma are not included in figure 5 nor used in calculating the regression curve for the calcium intake vs. balance. From this curve the average calcium intake necessary for equilibrium is calculated to be 18.5 mg./Kg./day. For the phosphorus data, if only the values for intakes less than 23 mg./Kg./day are used to calculate the regression curve, the average phosphorus intake necessary for equilibrium may be computed to be 18.7 mg./Kg./day.

Discussion

The value of 18.5 mg. calcium /Kg./day, which in the present study was found to represent the intake required for maintaining calcium balance in elderly men, is considerably higher than the value of 8 to 12 mg./Kg./day reported in the literature for young adults. This finding of a higher calcium requirement for old than for young subjects is in good agreement with the studies by McCay and associates (4, 9) on young and old animals. The value of 18.5 mg./Kg./day is somewhat higher than the intake of 14.3 mg./Kg./day reported by Roberts, Kerr, and Ohlson (19) as the intake necessary for establishment of calcium balance in elderly women.

The urinary excretion of calcium in all our subjects, although slightly lower than the average, fell within the range found for normal subjects by Knapp (5). It is of interest to note that in the experiments by Kane and McCay (4) the difference in calcium balance between young and old animals was largely brought about by the greatly increased fecal excretion of calcium in the older animals.

Our results for the phosphorus balance are

TABLE 1. CALCIUM AND PHOSPHORUS BALANCES.

Subject	Days	Weight (Kg.)	Calcium (Mg./Kg.)				Phosphorus (Mg./Kg.)			
			Intake	Output		Balance	Intake	Output		Balance
				Urine	Stool			Urine	Stool	
De	50	55.5	17.82	1.30	17.80	- 1.30	20.35	10.91	9.18	+0.26
	50	54.0	19.90	1.19	18.31	+ 0.40	22.30	12.85	7.76	+1.69
	70	54.6	15.43	1.29	15.80	- 1.64	18.42	10.58	7.40	+0.42
Ad	70	52.6	17.01	2.38	17.40	- 2.77	20.74	9.18	10.66	+0.90
	70	52.8	19.88	1.90	16.75	+ 1.23	26.22	13.94	11.56	+2.72
Mc	50	64.1	19.55	1.32	18.40	- 0.17	21.00	8.42	10.70	+1.88
	50	62.1	17.62	1.54	16.50	- 0.38	20.02	10.13	8.82	+1.03
	50	60.9	17.86	1.27	16.84	- 0.25	19.32	9.50	8.86	+0.96
Ki	30	46.6	14.05	1.35	15.62	- 3.88	17.75	7.52	12.26	-1.57
	40	46.7	31.43	1.14	28.68	+ 1.59*	34.42	12.40	17.92	+6.20*
	40	46.9	16.77	1.32	15.11	+ 0.34	24.58	11.41	11.74	+1.43
	30	47.2	17.85	1.57	14.33	+ 1.95	23.70	11.54	10.02	+2.04
Ko	60	66.5	20.04	1.66	17.25	+ 1.13	21.89	8.16	11.67	+2.06
	60	66.3	17.75	1.95	16.60	- 0.80	20.46	8.48	11.11	+0.87
	50	66.8	18.30	2.07	15.34	+ 0.93	19.40	9.28	9.50	+0.62
Ta	60	60.3	19.13	1.37	16.52	+ 1.24	20.93	10.10	10.36	+0.47
Os	30	40.7	17.21	1.98	16.02	- 0.79	20.21	10.70	8.38	+1.13
	30	41.0	13.65	1.97	16.36	- 4.68	17.95	9.44	8.84	-0.33
	50	42.9	14.66	2.30	16.86	- 4.50	21.50	12.04	7.80	+1.44
	30	44.3	19.69	2.10	16.23	+ 1.36	26.25	14.85	8.65	+2.75
Ma	40	62.4	19.20	1.73	33.30	-15.83*	21.26	5.80	15.06	+0.40
	40	63.0	16.88	1.75	32.80	-17.73*	19.85	7.19	10.60	+2.06
	30	64.0	30.28	1.72	36.58	- 6.42*	28.30	8.91	15.14	+4.25
	30	63.6	33.15	1.46	40.20	- 8.51*	29.31	10.78	14.64	+3.81

*Not shown on Figure or used in calculation

not greatly different from those found by others in both young and old subjects (7, 10, 17, 19). The conclusion, therefore, seems warranted that in spite of the increased calcium requirements, the phosphorus requirement is not greatly changed in old age. The observations on subject No. 8 Ma, who was the only one of the 8 individuals who was in marked negative calcium balance, are of considerable interest, since they show that the negative balance was due to increased fecal excretion, the urinary excretion being essentially the same as in the other subjects. The patient remained in negative calcium balance even on an intake of 2 Gm. of calcium per day, in spite of the fact that his phosphorus balance was similar to that of the other subjects. This patient was the only one in the group whose bones on x-ray examination showed definite evidence of osteoporosis.

Summary

The calcium and phosphorus balance was studied in 8 elderly men between the ages of 69 and 77 years, who were in relatively good health and in positive nitrogen balance. In 7 of the 8 individuals the average calcium and phosphorus intakes required for equilibrium were respectively 18.5 and 18.7 mg./Kg./day. The eighth subject was in negative calcium ballance even on an intake of 2.0 Gm. of calcium per day although his phosphorus balance was similar to that of the other subjects. It is concluded that the calcium requirement is greater for old men than for young adults.

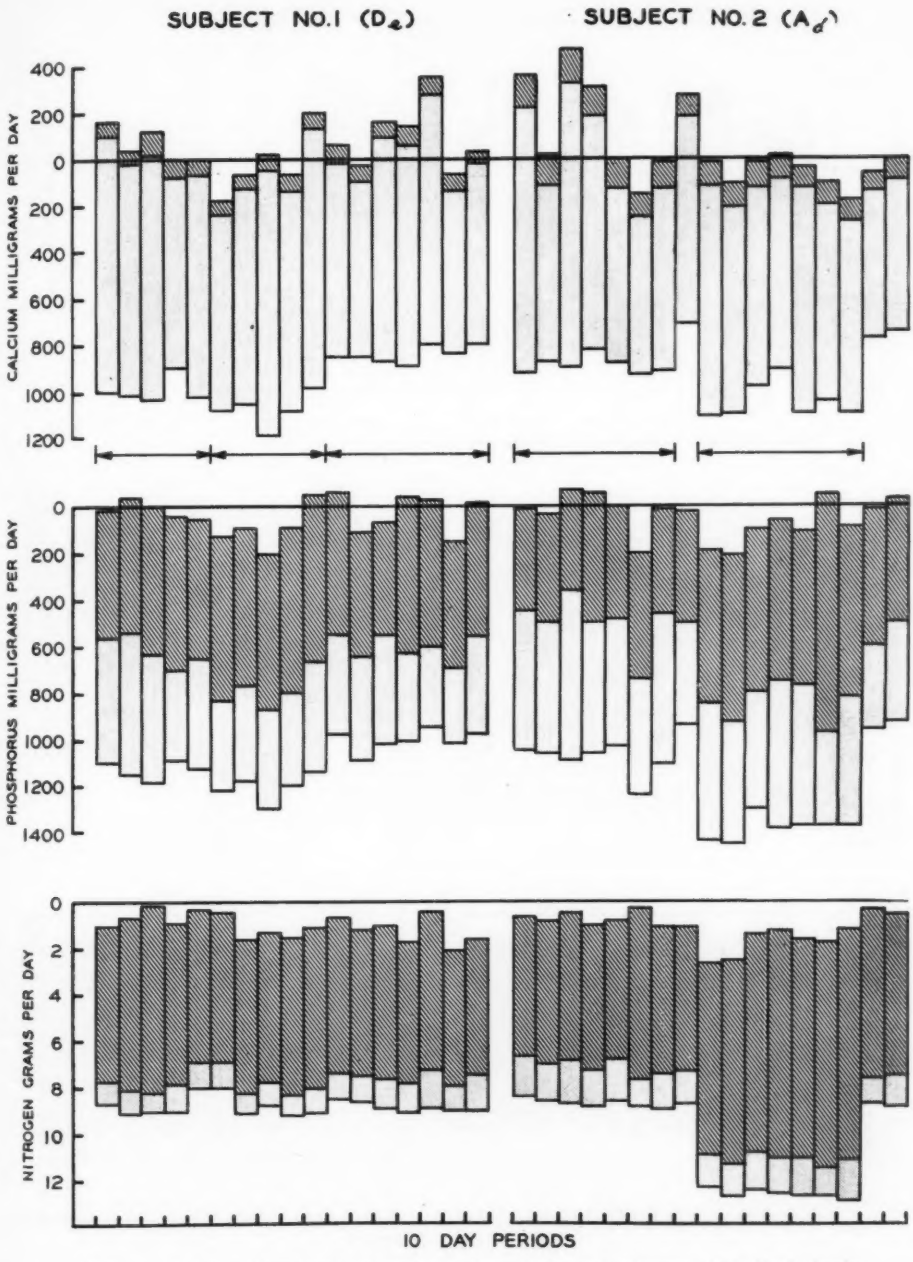

FIG. 1. Calcium (mg./day), phosphorus (mg./day), and nitrogen (Gm./day) intake and balance in Subject No. 1 (De) and Subject No. 2 (Ad). The upper hatched portion of each column represents the urinary excretion, the lower shaded portion the fecal excretion. Arrows indicated periods taken for the averages in table 1.

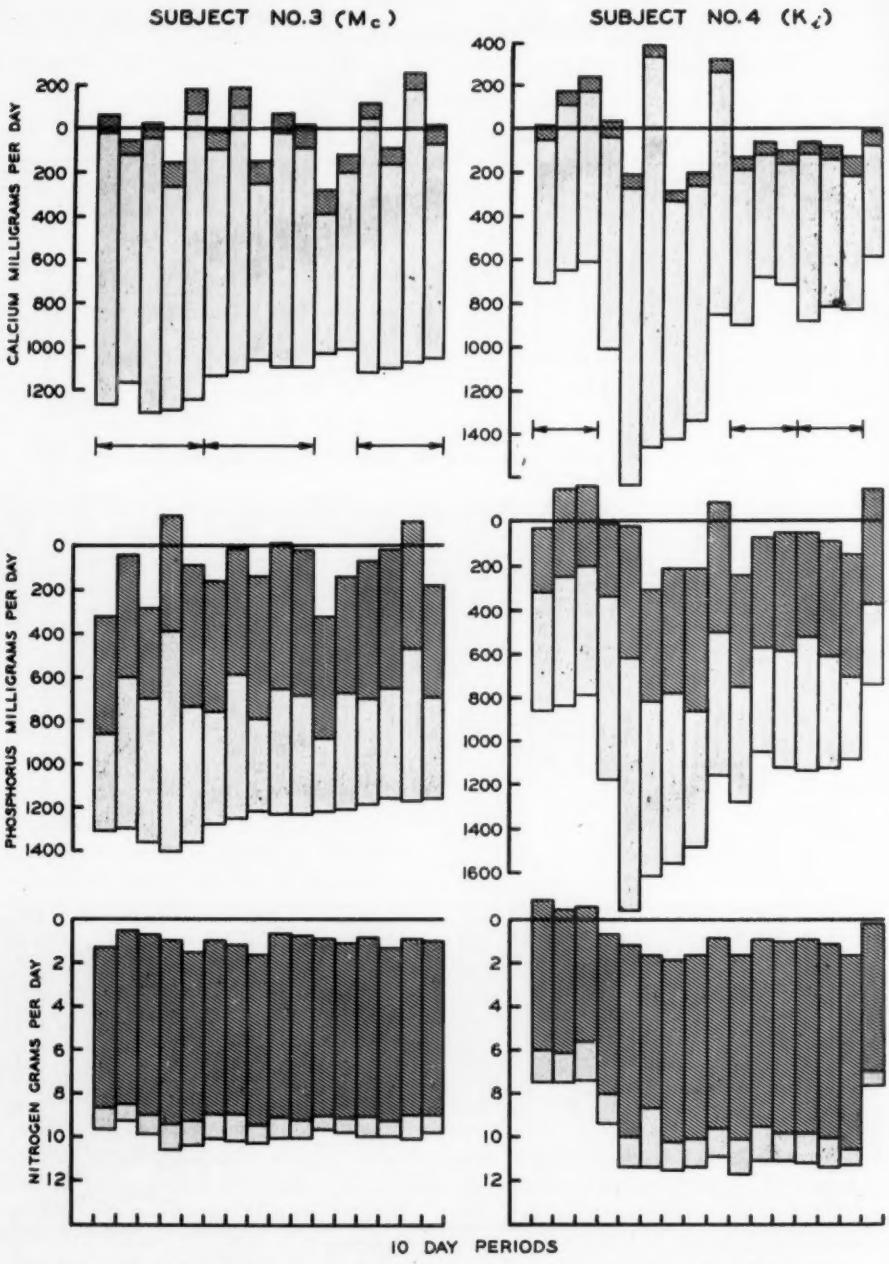

FIG. 2. Calcium (mg./day), phosphorus (mg./day), and nitrogen (Gm./day) intake and balance in Subject No. 3 (Mc) and Subject No. 4 (Ki). The upper hatched portion of each column represents the urinary excretion, the lower shaded portion the fecal excretion. Arrows indicate the periods taken for the averages in table 1.

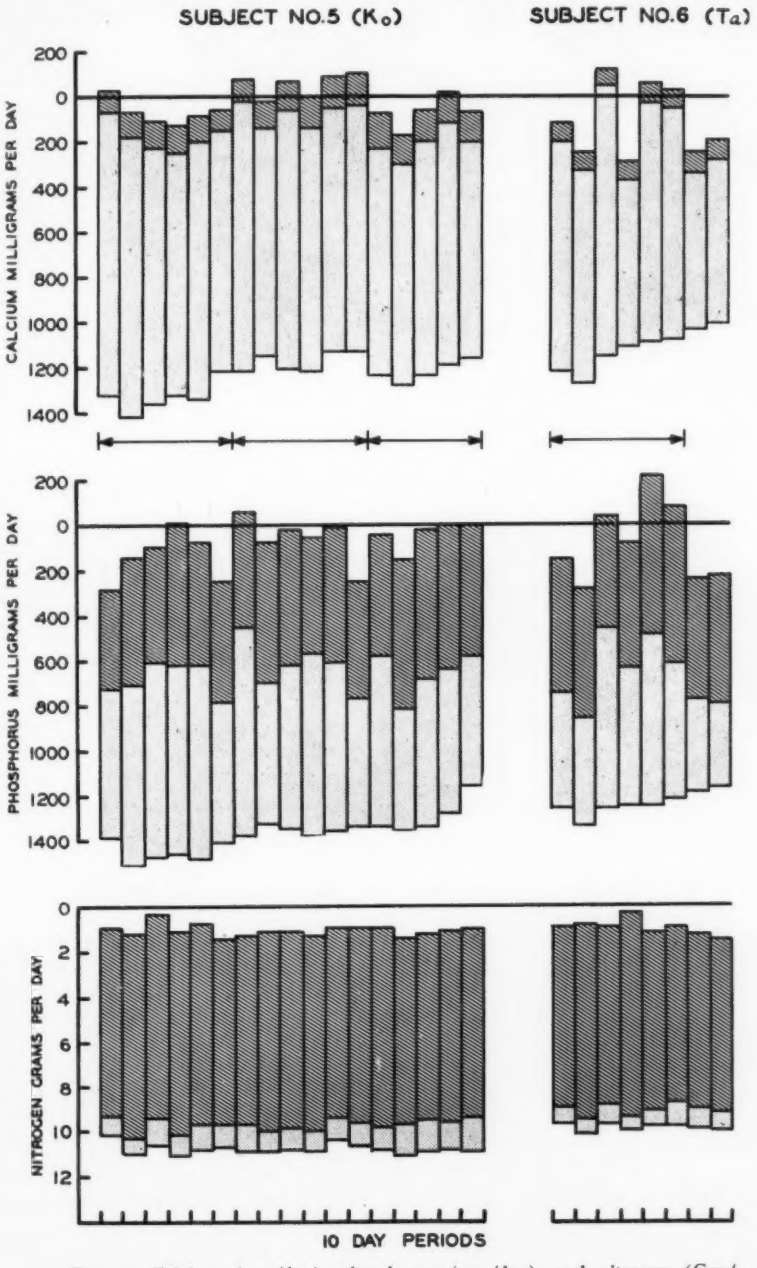

FIG. 3. Calcium (mg./day), phosphorus (mg./day), and nitrogen (Gm./day) intake and balance in Subject No. 5 (Ko) and Subject No. 6 (Ta). The upper hatched portion of each column represents the urinary excretion, the lower shaded portion the fecal excretion. Arrows indicate the periods taken for the averages in table 1.

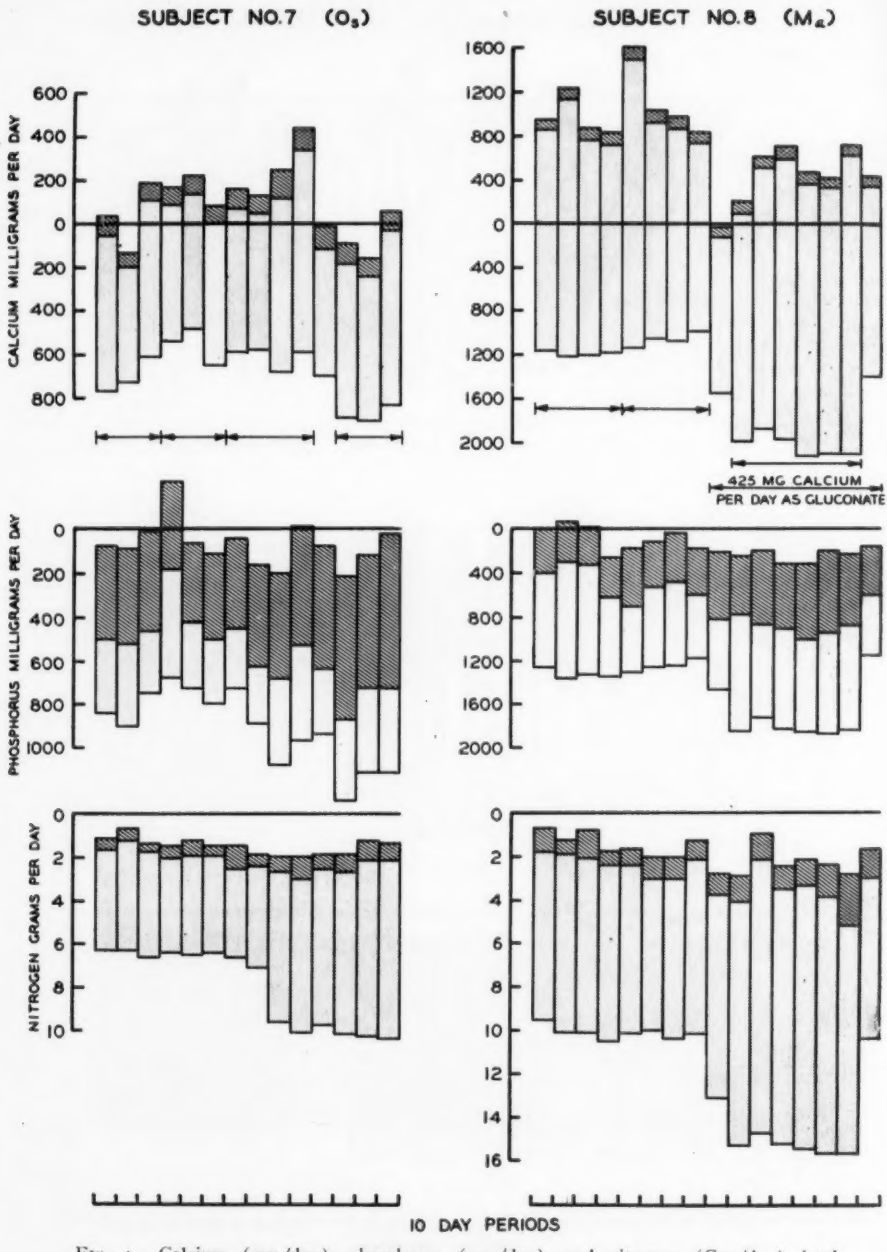

FIG. 4. Calcium (mg./day), phosphorus (mg./day), and nitrogen (Gm./day) intake and balance in Subject No. 7 (Os) and Subject No. 8 (Ma). Note change of scale for Subject No. 8. The upper hatched portion of each column represents the urinary excretion, the lower shaded portion the fecal excretion. Arrows indicate the periods taken for the averages in table 1.

whereas the phosphorus requirement seems to be of the same order of magnitude.

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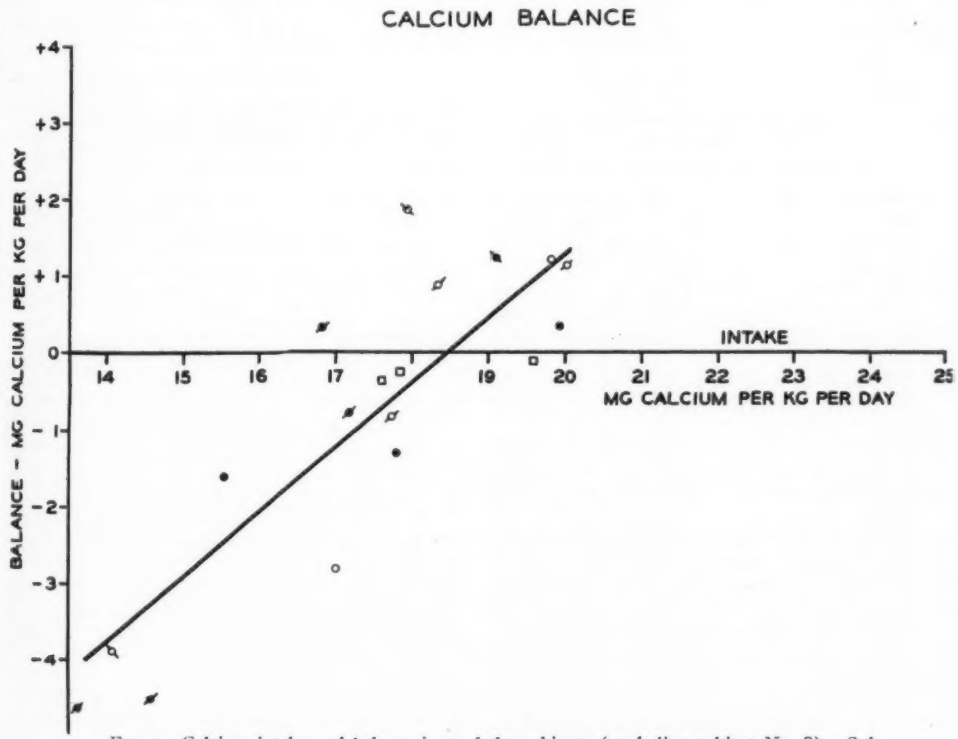

FIG. 5. Calcium intake and balance in 7 of the subjects (excluding subject No. 8). Subject No. 1, solid circles; No. 2, open circles; No. 3, squares; No. 4, open circles with diagonal line to left; No. 5, open circles with diagonal line to right; No. 6, solid circles with diagonal line to left; No. 7, solid circles with diagonal line to right. Data from table 1 plotted as milligrams of calcium per kilogram body weight per day. Regression line calculated by method of least squares.

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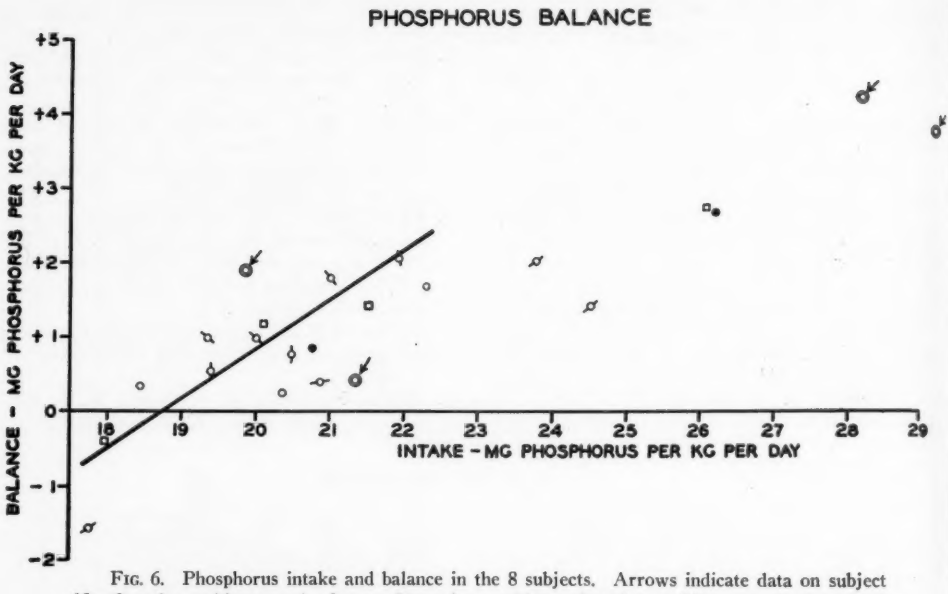

FIG. 6. Phosphorus intake and balance in the 8 subjects. Arrows indicate data on subject No. 8; other subjects as in fig. 5. Data from table 1 plotted as milligrams of phosphorus per kilogram body weight per day. Regression line calculated by method of least squares.

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Submitted for publication November 1, 1952

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Vitamin Studies in Middle-Aged and Old Individuals. XI.

The Concentration of Total Ascorbic Acid in Whole Blood

J. E. KIRK AND M. CHIEFFI

STUDIES on the effect of age on the ascorbic acid content of the blood have been reported by several investigators, most of whom conclude that the ascorbic acid blood concentration tends to be lower in old than in young individuals (3, 4, 5, 7, 8, 9, 11, 12). It has further been generally observed that the ascorbic acid blood values are greatly influenced by the ascorbic acid content of the food, resulting in a marked seasonal variation in the blood ascorbic acid levels. For this reason comparisons between blood ascorbic acid values for individuals of different ages are restricted to data obtained at approximately the same time of the year and in the same geographic area. In some of the surveys the investigations have been confined to individuals who were patients or inmates of hospitals or institutions, whereas in other studies the blood ascorbic acid levels of non-institutionalized persons consuming a self-selected diet have been measured.

Westergaard (12) examined the content of reduced ascorbic acid in plasma in 30 patients committed to an institution for the aged in Copenhagen. The study, which was carried out during the month of March, showed a zero ascorbic acid value in 27 out of the 30 patients. The mean age of the individuals was 75 years (range 64 to 88 years). In connection with the study of the patients, determinations of the serum ascorbic acid level were performed in 31 employees, who received their food from the same hospital kitchen. The mean ascorbic acid level observed in this latter group of persons was 0.28 mg. per cent; only in 3 of the employees was ascorbic acid absent from the serum. The mean age of the control persons was 33 years; 3 of the employees were above 50 years of age. Although a marked difference in serum ascorbic acid concentration was thus found by Westergaard between the elderly patients and the young and middle-aged employees a calculation of the correlation between age and ascorbic acid level for the personnel group fails to show any significant correlation for the two factors within this sample ($r = +0.19$, $t = 1.04$).

Trier (11) investigated the concentration of reduced ascorbic acid in serum in 707 adult individuals, 92 of whom were 65 years or older, in connection with their admission to a Copenhagen hospital. The analyses showed a definite tendency for the serum ascorbic acid values to decrease with age. Thus for the period January-February the mean ascorbic acid serum value for 15 to 24 year old persons was found to be 0.34 mg. per cent, for 35 to 44 year old individuals 0.26 mg. per cent, and for the patients 65 years of age and older 0.23 mg. per cent. For the other months of the year the corresponding figures for the young, middle-aged, and old subjects were: March-April: 0.36, 0.28, 0.27, May-June: 0.26, 0.23, 0.13, July-August: 0.57, 0.43, 0.39, September-October: 0.48, 0.37, 0.29, and November-December: 0.35, 0.30, 0.28.

Difs (5) studied the reduced ascorbic acid content of serum in 53 normal men in Uppsala, Sweden, during the months of May and June. The persons, whose ages ranged between 17 and 82 years, consumed a self-selected diet. The analyses showed a tendency for the serum ascorbic acid values to decrease with age. Thus the mean ascorbic acid serum concentration for 17 to 39 year old individuals was 0.16 mg. per cent, for the 40 to 49 year old subjects 0.14 mg. per cent, for the 50 to 59 year old persons 0.10 mg. per cent, and for the 60 to 82 year old men 0.10 mg. per cent. A calculation of the coefficient of correlation age/serum ascorbic acid from the data reported by Difs shows however that the observed decrease in serum ascorbic acid with age is not statistically significant ($r = -0.21$, $t = 1.50$).

Hagtvet (7, 8) in Norway measured the reduced ascorbic acid content of serum in 722 normal individuals between the ages of 20 and 50 years and in 89 hospitalized subjects above 60 years of age. The studies were conducted through various seasons of the year. The mean ascorbic acid values found, expressed in mg. per cent, were as follows, the figures in parantheses denoting the concentrations observed in the old patients: April: 0.22 (0.05), May: 0.21 (0.05), June: 0.16 (0.05), August: 0.93 (0.19), September: 0.89 (0.27), October: 0.87 (0.45). In all the months studied the serum ascorbic acid levels of the young and middle-aged normal adults were thus about two to five times higher than the concentrations observed in the aged patients.

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An extensive survey of the level of reduced ascorbic acid in serum in individuals of various ages has further been conducted by Andersen and Normann (1, 6) under the auspices of the Danish State Department of Health. The study included a total of 3727 non-institutionalized persons who consumed a self-selected diet. The investigation was mainly concerned with individuals between 0 and 59 years and therefore does not permit conclusions with regard to the effect of old age on the blood ascorbic acid values; because of the large sample size, for the age range included in the study, the data must be considered as very valuable. During the months of December, January, and February, in which period of the year the variations in the ascorbic acid content of the food are negligible, a total of 863 persons, 444 men and 419 women, were examined. The investigation of the men showed the following average values and standard deviations for the serum ascorbic acid concentration: 0 to 9 years: 0.34 mg. per cent (s.d. 0.17, N = 79), 10 to 19 years: 0.33 mg. per cent (s.d. 0.17, N = 76), 20 to 29 years: 0.36 mg. per cent (s.d. 0.16, N = 66), 30 to 49 years: 0.33 mg. per cent (s.d. 0.16, N = 187), 50 to 59 years: 0.36 mg. per cent (s.d. 0.15, N = 36). The corresponding values observed for the women were: 0 to 9 years: 0.34 mg. per cent (s.d. 0.22, N = 52), 10 to 19 years: 0.35 mg. per cent (s.d. 0.15, N = 80), 20 to 29 years: 0.37 mg. per cent (s.d. 0.17, N = 80), 30 to 49 years: 0.35 mg. per cent (s.d. 0.18, N = 192), 50 to 59 years: 0.30 mg. per cent (s.d. 0.12, N = 15). It may be concluded from these data that the serum ascorbic acid concentration of Danish non-institutionalized persons showed no tendency to decline between the ages of 0 and 59 years.

Measurements of the total ascorbic acid concentration of serum in 367 individuals between the ages of 0 and 89 years were carried out by a group of Canadian and American investigators (2) in connection with an extensive nutritional survey of the Newfoundland population. The analyses, performed during the month of August, showed a mean ascorbic acid concentration at age 8 of 0.60 mg. per cent; the corresponding values at 12, 16, 22, 30, and 55 years were 0.46, 0.32, 0.28, and 0.30. Values above the age of 55 years are not given in the report.

The present study was undertaken with the purpose of examining the effect of age on the total ascorbic acid (reduced ascorbic acid plus dehydroascorbic acid) concentration of whole blood in a group of middle-aged and old individuals living under the same external conditions.

Experimental

The investigation comprised 142 subjects, 61 men and 81 women, between the ages of 40 and 103 years, who were inmates or patients of the St. Louis City Infirmary and Infirmary Hospital. Individuals suffering from infectious or gastrointestinal diseases (except gastric achlorhydria) or from malignant lesions were not included in the study. The investigation was conducted between the dates of July 16 and August 31. During this period the mean daily ascorbic acid content of the food offered the patients was 45 mg., as determined by analysis of the prepared diet. The amount of food eaten by the individual patients was not measured, but only such subjects who consumed the major part of the offered diet were included in the investigation. None of the individuals had received vitamin preparations for several months prior to the blood analysis. In no instance were clinical signs of scurvy observed. For comparative purposes the blood ascorbic acid concentrations of a group of young adults between 16 and 39 years of age were also determined; these subjects were private volunteers who consumed a self-selected diet, the ascorbic acid content of which was not assayed.

Blood for ascorbic acid determination was collected in the morning from the fasting individuals. The ascorbic acid analyses were performed on whole blood by the procedure of Roe and Kuether (10), using a Colemann No. 14 spectrophotometer. This analysis includes both reduced ascorbic acid and dehydroascorbic acid in the same determination. The average error of the method was 2.1 per cent.

Results

Table 1 contains the summarized values for the age groups 40 to 59, 60 to 69, 70 to 74, 75 to 79, and 80 to 103 years, and the values for the men and women separately. The values obtained in the 16 to 39 year old individuals are listed at the bottom of the table. It will be seen that the blood ascorbic acid concentration in the institutionalized men decreases from a mean value of 0.59 mg. per cent in the 40 to 59 year age group to 0.33 mg. per cent in the 80 to 103 year group. A calculation of the coefficient of correlation age/blood ascorbic acid concen-

TABLE 1. THE CONCENTRATION OF TOTAL ASCORBIC ACID OF WHOLE BLOOD IN 169 INDIVIDUALS.

Age Group	Number	Ascorbic acid in blood		
		Mean mg. per cent	Range mg. per cent	s. d.*
40- 59	Men 8	0.59	0.32-1.20	0.32
40- 59	Women 9	0.48	0.12-1.10	0.29
60- 69	Men 19	0.42	0.21-1.07	0.22
60- 69	Women 13	0.42	0.26-0.75	0.16
70- 74	Men 14	0.41	0.21-0.91	0.12
70- 74	Women 14	0.43	0.16-0.66	0.21
75- 79	Men 9	0.35	0.19-0.49	0.10
75- 79	Women 20	0.41	0.21-0.76	0.17
80-103	Men 11	0.33	0.14-0.48	0.12
80- 87	Women 25	0.40	0.19-0.76	0.13
16- 39	Men 17	0.82	0.59-1.04	0.14
16- 39	Women 10	1.02	0.60-1.22	0.18

*Standard deviation of distribution.

tration for the 40 to 103 year old men gives a value of -0.44 ($t = 3.20$, $N = 61$). For the 70 to 103 year group the r value is -0.46 ($t = 2.93$, $N = 34$).

In the case of the institutionalized women a decrease in mean ascorbic acid level with age is also noted, namely from an average value of 0.48 mg. per cent in the 40 to 59 year group to 0.40 mg. per cent in the 80 to 87 year group. This decrease in ascorbic acid blood concentration with age is not statistically significant ($r = -0.05$, $t = 0.45$, $N = 81$).

The mean ascorbic acid blood concentration observed in the young men was twice, and in the young women two and a half times as high as the average value found for the institutionalized middle-aged and old persons.

DISCUSSION

The results of the present study have shown a significant decline in the blood ascorbic acid value of institutionalized men with age, whereas no statistically certain decrease was noted in the women. The findings are not directly comparable with the results of previous investigations, since no data so far have been reported on ascorbic acid blood values in a larger group of institutionalized middle-aged and old individuals. The observation in the present study that hospitalized old men tend to have lower blood ascorbic acid values than non-institutionalized young adults is in agreement with the finding by Hagtvet (7, 8).

The important problem of the existence of a causal correlation between age and low ascorbic acid values cannot be solved on the basis of the present data. Although such correlation is suggested in the case of the men proof of the existence of a correlation could be obtained only through determination of the blood ascorbic acid level on a standardized ascorbic acid intake. The possibility of an interdependence between the degree of debilitation of the patients and the blood ascorbic acid concentrations must be considered. If existing, it might explain the greater tendency to a decline with age in the blood ascorbic acid content in the men than in the women, since the male inmates in general show more evidence of debilitation than do the female patients. It has been shown by Hagtvet (8) that various diseases, including some which are not related to the gastro-intestinal tract, often are associated with low blood ascorbic acid levels. Since debilitation in the aged probably in many instances reflects the presence of undiagnosable disease conditions an analysis of the eventual significance of debilitation for the development of low blood ascorbic acid concentrations will be attended with considerable uncertainty, and such evaluation has therefore not been attempted in the present study.

SUMMARY

A study of the concentration of total ascorbic acid of whole blood in 142 institutionalized persons (61 men and 81 women) between the ages of 40 and 103 years revealed a statistically significant decline in the ascorbic acid concentration with age in the men ($r = -0.44$,

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$t = 3.20$), but not in the women ($r = -0.05$, $t = 0.45$). The significance of the findings is discussed.

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The authors are indebted to the Danish State Department of Health for making available the unpublished results of the nutrition survey.

The study was supported by a grant from Hoffmann-La Roche, Inc.

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Submitted for publication April 15, 1953

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Vitamin Studies in Middle-Aged and Old Individuals

XII. Hypovitaminemia C. Effect of Ascorbic Acid Administration on the Blood Ascorbic Acid Concentration

J. E. KIRK AND M. CHIEFFI

In a previous publication (1) by the present authors the frequent occurrence of lowered blood ascorbic acid values in aged individuals was reported. The factors responsible for the high incidence of hypovitaminemia C in old age have not so far been definitely ascertained. As possible causes for a reduction in the blood ascorbic acid content an inadequate ascorbic acid intake in the food, excessive destruction of the vitamin in the gastrointestinal tract, and impaired absorption must be considered. In addition, a low ascorbic acid level of the blood may be conditioned by an abnormal renal excretion of ascorbic acid and by an increased utilization of the vitamin in the tissue metabolism.

The present study was undertaken with the purpose of investigating the efficacy of orally administered ascorbic acid in raising the blood ascorbic acid concentration in a group of middle-aged and old patients with hypovitaminemia C.

Experimental

Nineteen elderly patients, 10 men and 9 women, who in the previous investigation had been found to have blood ascorbic acid concentrations below 0.30 mg. per cent, were selected for the study. The average blood ascorbic acid concentration before the commencement of therapy was 0.26 mg. per cent (s.d. 0.03). The subjects were inmates or patients in the St. Louis City Infirmary or Infirmary Hospital. The mean age of the men was 70 years (range 61 to 83 years) and of the women 64 years (range 52 to 84 years).

The blood samples for ascorbic acid analysis were drawn in the morning from the fasting individuals. The determinations were performed on whole blood by the method of Roe and Kuether (2) as described in the previous communication. This analysis includes both ascorbic acid and dehydroascorbic acid in the same determination.

After the initial blood ascorbic acid level had been ascertained the subjects were given one tablet of 100 mg. ascorbic acid by mouth daily for a period of 14 weeks. The tablet was given in connection with or immediately following breakfast. The administration was supervised by the Division's research nurse.

Determinations of the blood ascorbic acid level were performed after 2, 5, 10, and 14 weeks of therapy, and 2, 4, and 8 weeks following discontinuation of the treatment.

Results

In 16 out of the 19 patients the administration of 100 mg. of ascorbic acid by mouth daily was followed by a marked rise in the blood ascorbic acid concentration. The values observed in the individual subjects are reproduced in figure 1, whereas the mean ascorbic acid blood concentrations for the group of 16 persons are shown in figure 2. As it will be seen from the latter figure the mean ascorbic acid blood value after 2 weeks of therapy had already increased to 0.96 mg. per cent. After 5 weeks the maximal concentration of 1.15 mg. per cent had been reached. The blood ascorbic acid value was maintained at approximately this level during the remaining 9 weeks of treatment. Following discontinuation of the ascorbic acid ingestion the blood ascorbic acid content quickly decreased, and after 8 weeks had reached a mean value of 0.31 mg. per cent, a level which was only slightly higher than

THE EFFECT OF ORAL ADMINISTRATION OF 100 MILLIGRAMS OF ASCORBIC ACID DAILY ON THE BLOOD ASCORBIC ACID CONCENTRATION IN 16 OLD INDIVIDUALS

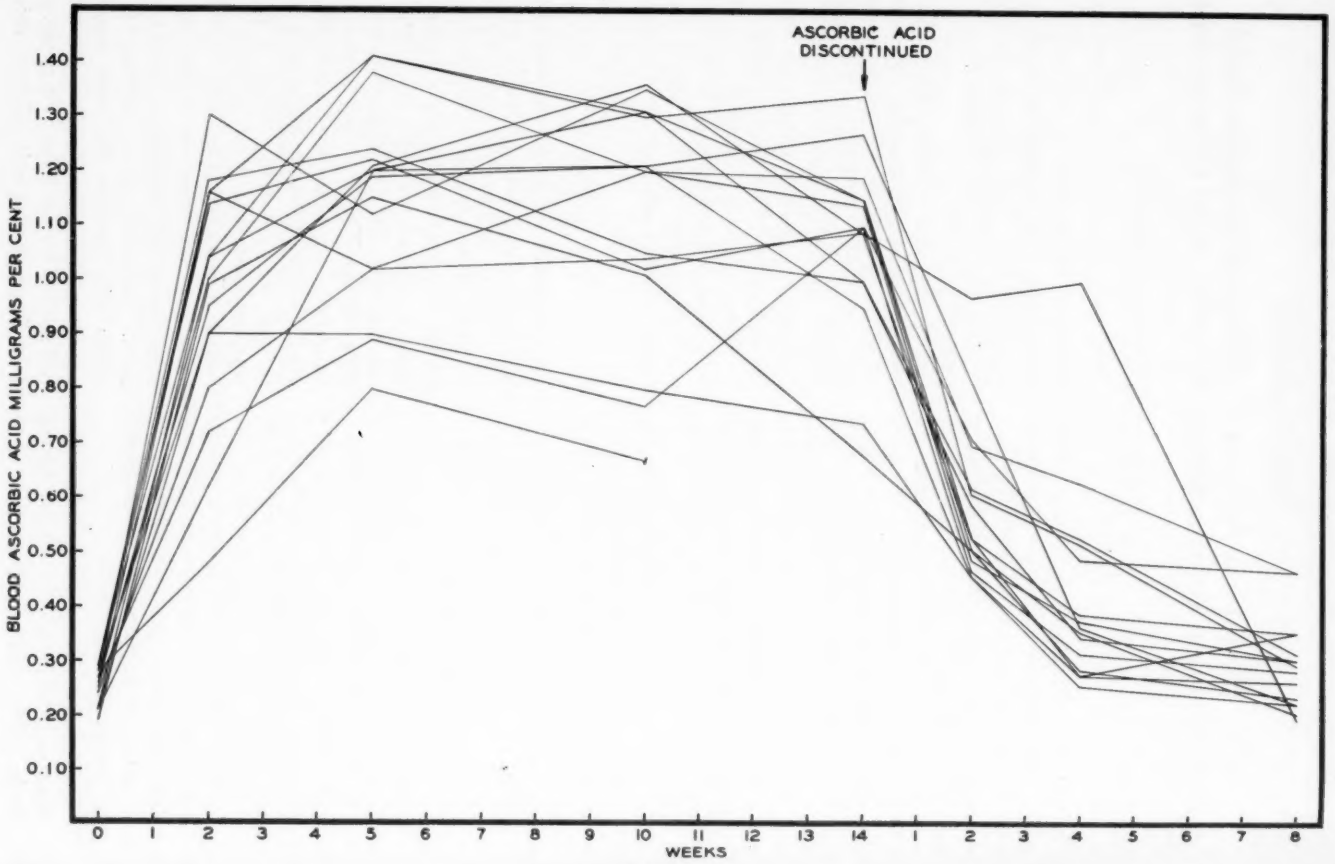

FIGURE 1

THE EFFECT OF ORAL ADMINISTRATION OF 100 MILLIGRAMS OF ASCORBIC ACID DAILY

WEEKS

FIGURE 1

THE EFFECT OF ORAL ADMINISTRATION OF 100 MILLIGRAMS OF ASCORBIC ACID DAILY ON THE MEAN BLOOD ASCORBIC ACID CONCENTRATION IN 16 OLD INDIVIDUALS

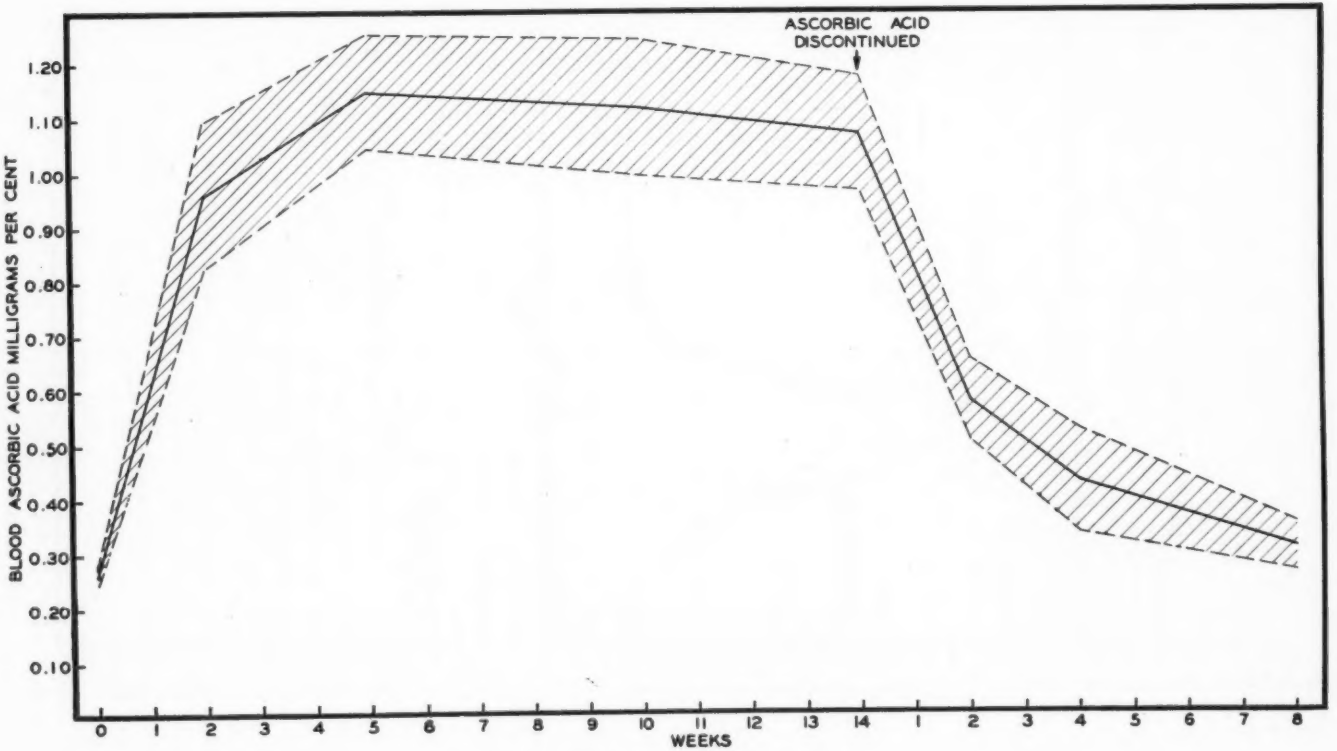

FIG. 2. Shaded area represents ± 0.5 s.d.

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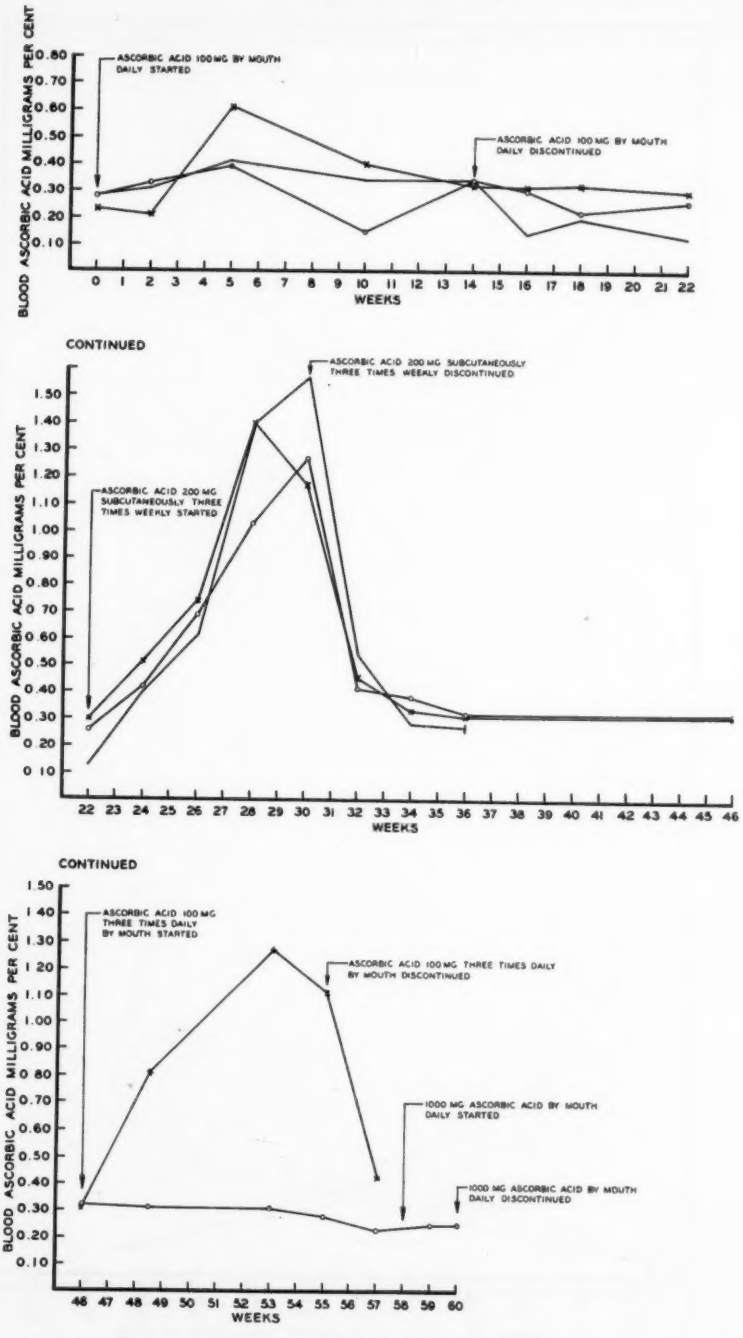
BLOOD ASCORBIC ACID MILLIGRAMS PER CENT
ASCORBIC ACID 100 MG BY MOUTH DAILY STARTED
ASCORBIC ACID 100 MG BY MOUTH DAILY DISCONTINUED
WEEKS
CONTINUED
ASCORBIC ACID 200 MG SUBCUTANEOUSLY THREE TIMES WEEKLY DISCONTINUED
ASCORBIC ACID 200 MG SUBCUTANEOUSLY THREE TIMES WEEKLY STARTED
CONTINUED
ASCORBIC ACID 100 MG THREE TIMES DAILY BY MOUTH STARTED
ASCORBIC ACID 100 MG THREE TIMES DAILY BY MOUTH DISCONTINUED
1000 MG ASCORBIC ACID BY MOUTH DAILY STARTED
1000 MG ASCORBIC ACID BY MOUTH DAILY DISCONTINUED

FIG. 3. Effect of ascorbic acid administration on the blood ascorbic acid concentration in subjects G.T., P.M. and A.H.

. Subject G.T.
x Subject P.M.
o Subject A.H.

the average concentration observed before the onset of the therapy.

In contrast to the fairly uniform response to oral administration of ascorbic acid noted in the 16 individuals, the ascorbic acid ingestion in the remaining 3 patients proved ineffective in increasing the blood ascorbic acid level (fig. 3). These 3 individuals were therefore subjected to further study. A summary of the clinical findings in the patients is given below:

G. T., white male, 63 years. Height 163 cm., weight 36.8 Kg. Had been committed to a sanitarium 1938-1943 for paranoid schizophrenia and had since been a patient in the St. Louis City Infirmary. During the stay in the Infirmary had been quiet and cooperative and had not presented behavior problems. The existence of arterial hypertension was first noted in 1938. The blood pressure since 1943 had ranged between 210/100 and 260/130.

Physical examination performed in connection with the present study revealed a moderate enlargement of the heart. The eyegrounds showed hypertensive changes. EKG was within normal limits. There were no clinical signs of cardiac decompensation. Kahn's test was negative. There was atrophy of the muscles of both lower extremities, hyperactive patellary reflexes, and bilateral positive toe sign. Because of incoordination the patient was confined to a wheel chair.

The patient died during the course of the study. Autopsy revealed extensive old vascular brain lesions and the presence of a fresh cerebral hemorrhage, extending into the ventricles.

Analysis of the fasting gastric secretion showed the following values: volume, 11 ml. pH 1.23; free acidity, 7.5 ml. of 0.1 N NaOH required for neutralization of 10 ml. gastric juice; total acidity, 10.5 ml. of 0.1 N NaOH required for neutralization of 10 ml. gastric juice.

P. M., white female, 58 years. Height 160 cm., weight 52.3 Kg. Had been committed to a sanitarium 1937-1947 because of mental deficiency and had since been a patient in the St. Louis City Infirmary. Physical examination during the stay in the Infirmary revealed the presence of a nodular goiter associated with hyperthyroidism (BMR +37 to +48 per cent). The blood pressure was elevated and ranged between 180/100 and 230/100. The heart was moderately enlarged and there was some dilatation of the aorta. EKG was within normal limits. There were no clinical signs of cardiac decompensation. Kahn's test was negative. The patient responded to treatment with propylthiouracil.

Analysis of the fasting gastric secretion showed the following values: volume, 16 ml. pH 1.42; free acidity, 5.3 ml. of 0.1 N NaOH required for neutralization of 10 ml. gastric juice; total acidity, 8.0 ml. of 0.1 N NaOH required for neutralization of 10 ml. gastric juice.

A. H., white male, 65 years. Height 169 cm., weight 63.5 Kg. Had been committed to a sanitarium 1934-1943 for general paresis and had since been a patient in the St. Louis City Infirmary. Kahn and Wassermann reactions were positive in 1933 and 1940. Spinal fluid examination in 1940 showed changes consistent with diagnosis of cerebrospinal syphilis. After antisyphilitic treatment the serology became negative and the spinal fluid normal.

Physical examination in relation to the present study showed the mental condition to be satisfactory. The pupils were pin point and did not react to light or accommodation. Patellary reflexes were present. The blood pressure was 140/70. There was no enlargement of the heart and no evidence of vavular disease. EKG was within normal limits. Kahn's test was negative.

The patient refused to submit himself to gastric analysis. X-ray examination of the gastrointestinal tract revealed no pathologic condition.

In order to evaluate the reason for the failure of the 3 patients to respond to oral ingestion of 100 mg. of ascorbic acid with an increase in the blood ascorbic acid concentration, 200 mg. of ascorbic acid was given subcutaneously 3 times weekly for a period of 8 weeks. As it will be seen from figure 3, the parenteral administration of the vitamin, in contrast to the oral ingestion, in all the 3 subjects was followed by a marked increase in the blood ascorbic acid concentration, which after 6 to 8 weeks of therapy reached a maximum value at a level between 1.27 and 1.57 mg. per cent. When the parenteral administration of ascorbic acid was discontinued the blood ascorbic acid content within 2 to 4 weeks again decreased to the pretreatment values.

Since it had thus been shown that parenteral administration of ascorbic acid was capable of raising the blood ascorbic acid level, it became of interest to investigate whether a high oral intake of ascorbic acid likewise would prove effective in increasing the blood ascorbic acid concentration. For this purpose a dose of 300 mg. of ascorbic acid was given daily by mouth to the subjects P. M. and A. H. for a period of 9 weeks. As seen from figure 3, such dose of ascorbic acid in patient P. M. was followed by a definite increase in the blood ascorbic acid concentration, namely from a value of 0.31

mg. per cent to a level of 1.27 mg. per cent, whereas in A. H. the administration was without any effect on the blood ascorbic acid content. The dose of ascorbic acid in the latter patient was later raised to 1000 mg. daily (fig. 3), but even this dose proved ineffective in causing an increase in the blood ascorbic acid concentration.

Discussion

The observed response in 16 out of 19 individuals with hypovitaminemia C to oral administration of 100 mg. of ascorbic acid daily indicates that in the majority of old subjects with reduced blood ascorbic acid levels the administered ascorbic acid is adequately absorbed from the gastrointestinal tract. The failure in the remaining 3 individuals to effect an increase in blood ascorbic acid with an oral dose of 100 mg. of ascorbic acid daily in combination with the satisfactory response to a similar dose of ascorbic acid given parenterally suggests that in these patients there existed an impairment of absorption of ascorbic acid or that an excessive destruction of the compound occurred in the gastrointestinal tract. Which of these causes was operative cannot be decided on the basis of the present observations. The fact that the gastric secretion in 2 of the 3 subjects showed a normal content of hydrochloric acid excludes the possibility that gastric achlorhydria was the cause of the inadequate response to oral ascorbic acid therapy in the patients. It is of interest to note that a definite increase in the blood ascorbic acid level was obtained in 1 of the subjects when the oral dose of ascorbic acid was raised from 100 to 300 mg. daily.

The significance of low blood ascorbic acid values in the aged has not as yet been established. Since low blood ascorbic acid values in the aged usually are not associated with signs of scurvy or with other manifest clinical symptoms the desirability of raising the values to the blood ascorbic acid level found in normal young adults has been questioned. There seems to be a general agreement that the indications for ascorbic acid therapy in the aged, except in the case of scurvy, cannot be clearly delineated at the present stage of knowledge. On the other hand, it is also agreed that administration of ascorbic acid is not associated with any untoward symptoms.

In case it is considered desirable to treat hypovitaminemia C in the aged the observations in the present study allow various conclusions of practical importance. Thus the response in 16 out of 19 patients with low ascorbic acid blood values to the administration of one tablet of 100 mg. of ascorbic acid daily shows that such supplementation in most cases will constitute a sufficient measure for assuring blood ascorbic acid levels of the same magnitude as found in young adults. The fairly rapid decline in the blood ascorbic acid concentration noted after discontinuation of the ascorbic acid treatment implies that a continued supplementation with ascorbic acid may be necessary to prevent recurrence of low blood ascorbic acid values in such patients. The fact that the diet of old individuals contains an amount of vitamin C which is usually considered adequate according to existing norms apparently gives no guarantee against the development of low blood ascorbic acid values in this age group. Thus at the time of the outset of the present investigation the diet offered the patients contained an average of 45 mg. of ascorbic acid daily, as determined by assay of the prepared food.

The results obtained in patient P. M., in which subject a satisfactory increase in the blood ascorbic acid concentration was noted after the oral dose of ascorbic acid had been increased from 100 to 300 mg. daily indicate that in some patients a higher oral dose of ascorbic acid may be sufficient to effect the desired rise in the blood ascorbic acid concentration. In other patients, however, as in subject A. H. of the present study, who failed to respond to an oral ascorbic acid intake of 1000 mg. daily, it would seem necessary to administer the vitamin parenterally.

Summary

The effect of oral administration of 100 mg. of ascorbic acid daily on the blood ascorbic

acid concentration was studied in 19 elderly patients with hypovitaminemia C. The treatment in 16 of the 19 subjects caused an increase of the blood ascorbic acid content from a mean value of 0.26 mg. per cent to 1.15 mg. per cent, the latter value being reached after 5 weeks of therapy. In the remaining 3 individuals no definite increase in blood ascorbic acid was noted, but all 3 subjects responded to parenteral administration of the vitamin with an increase of the blood ascorbic acid level to between 1.27 and 1.57 mg. per cent. The significance of the observations is discussed.

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Funds and materials were provided by Hoffmann-La Roche, Inc.

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Submitted for publication April 15, 1953

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Casual Skin Lipid Levels in Individuals of Various Ages

KURT IVERSEN, AAGE VIDEBÆK, AND JOHN ESBEN KIRK

In a recent publication by Herrmann and Prose (1) a report is given of the amounts of material extractable with ethyl ether from the surface of various unprotected skin areas in human subjects. These quantities have been designated by Herrmann and Prose as "casual skin lipid levels." Since the values represent the concentrations of lipid material actually present on the skin surface under ordinary conditions they would seem to possess a considerable practical interest.

In the study by Herrmann and Prose the highest casual levels of ether extractable material were observed in the central region of the forehead, in which area the mean value found in 10 subjects was 0.244 mg. per sq. cm. of skin (s.d. 0.087). The analyses were performed gravimetrically on the residue from the ether extract of the surface material. This extract, besides material of lipid nature, will contain lactic acid, various amounts of salts, and epithelial debris.

The present study was undertaken with the purpose of determining the casual skin lipid levels on the forehead and on the hands in individuals of various ages, using a technique in which material of non-lipid nature is excluded.

Technique

The investigation included 144 subjects, 72 men and 72 women, distributed between 3 equal groups of young, middle-aged, and old persons. The age range was 13 to 90 years. The majority of the subjects were relatives accompanying patients attending an out-patient clinic; several of the old individuals were inmates of the St. Louis City Infirmary. In order to investigate the effect, if any, of the season on the casual skin lipid values one part of the study was carried out during the summer months and the other during the winter period. The mean outdoor temperature during the summer study was 29 C. and the mean relative humidity 68 per cent; during the winter study the average temperature was 3 C. and the humidity 73 per cent.

Collection of skin surface lipids. The samples were obtained between 9 and 11:30 a.m. without any previous preparation of the subjects, using the technique described in previous publications (2, 3, 4). Collections were made from a 10 sq. cm. area in the central region of the forehead and from three 2 sq. cm. areas on the back of the hand (one proximal, one central, and one distal area in the second intermetacarpal space). In several instances an additional sample was collected from a central area of the palm of the hand. A glass cylinder of appropriate dimensions was placed firmly against the skin surface and the lipid material removed by two successive additions of 5 ml. portions of redistilled ethyl ether, which were each left in contact with the skin surface for one minute. The ether portions were transferred by suction to a carefully cleaned tube, using all-glass equipment.

Isolation and analysis of the lipid material. For isolation of the lipids in the sample the procedure described by Kirk, Page, and Van Slyke (5) was employed. The ethyl ether was evaporated below 60 C. and the lipids in the residue redissolved in redistilled petroleum ether. The petroleum ether was subsequently passed through a sintered glass filter and made up to 10 ml. volume. The lipid determinations were made on 4.5 ml. aliquots, using the gasometric carbon method of Van Slyke, Page, and Kirk (7) with the factors given for mixed plasma lipids (5). Blank determinations on the combustion procedure were performed daily.

Results

The results of the determinations of the casual skin lipid levels on the forehead and on the back of the hand during the summer and winter periods are presented in tables 1 and 2.

Forehead. It will be seen from the tables that the mean skin lipid values found on the forehead in all the groups were markedly higher than the values observed on the back of the hand. The higher casual lipid level on the forehead is undoubtedly due to the high rate of sebaceous secretion in this skin area (4, 6) as compared with the minimal secretion present on the back of the hand (2, 3). The average value observed on the forehead for the 72 men was 0.239 mg. per sq. cm. (summer 0.210, winter 0.270) and for the 72 women 0.205 mg. per sq. cm. (summer 0.189, winter 0.222). The lower values for the casual lipid levels found during the summer months in both men ($t = 2.76$) and women ($t = 1.55$) are probably conditioned by the higher rate of perspiration and more frequent wiping and washing of the forehead during this season.

As mentioned above the mean values for the casual lipid level on the forehead tend to be higher in the men than in the women. This difference in the lipid values between the two sexes most likely reflects the higher rate of sebaceous secretion on the forehead in men than in women, as demonstrated in a previous study (4). The difference is significant only in case of the winter material ($t = 2.22$); it is reasonable to assume that the frequent wiping of the forehead during the summer season will tend to obscure the difference.

A calculation of the coefficients of correlation between age and casual lipid values on the forehead gives values of –0.24 ($t = 1.44$) for the men and –0.01 ($t = 0.06$) for the women in the summer study; for the winter material the corresponding coefficients are +0.11 ($t = 0.64$) and –0.30 ($t = 1.83$). None of these coefficients are statistically significant.

The casual skin lipid values found in the present investigation for the region of the forehead are in good agreement with the figures reported by Herrmann and Prose (1).

Back of Hand. The average value of the 216 lipid collections from the back of the hand was 0.072 mg. per sq. cm. in the men (summer 0.068, winter 0.075) and 0.080 mg. per sq. cm. in the women (summer 0.84, winter 0.075). Since the amount of sebum secreted in the dorsal region of the hand in a 24 hour period in previous investigations from this laboratory (2, 3) has been found to average only about 0.013 mg. per sq. cm., irrespective of the season, the magnitude of the values observed for the casual skin lipid level in this region indicates that the greater part of the lipid material must be derived from other sources (fat-containing soap bars; creams; contamination from contact of hand with forehead; contamination from other sources).

The difference in lipid values observed between the total number of men and women during the summer season is not statistically significant ($t = 0.55$). A study of the lipid values found in the subgroups shows, however, that young women tend to have higher lipid levels on the back of the hand than do young men. This difference is significant both in the summer ($t = 3.12$) and winter ($t = 3.22$) material. Since the rate of sebaceous secretion on the back of the hands in previous studies (2, 3) has been found to be the same in men and women, the difference in casual lipid values probably reflects a more widespread use of hand creams by young women than by young men. The casual lipid level is likewise higher in the group of young women than in the groups of middle-aged ($t = 0.75$ in the summer study, 2.30 in winter material) and old women ($t = 4.24$ in summer study, 2.18 in winter material); these differences are most likely also explainable by the more extensive use of cosmetic preparations by young women.

A calculation of the coefficients of correlation between age and casual skin lipid values on the back of the hand (average of 3 skin areas in each person) gives values of –0.01 ($t = 0.06$) for the men and –0.23 ($t = 1.38$)

TABLE 1. CASUAL SKIN LIPID LEVELS ON THE FOREHEAD AND THE BACK OF THE HAND IN 36 MEN AND 36 WOMEN DURING THE SUMMER PERIOD.

Values represent mg. of ether-petroleum ether soluble material per sq. cm. of skin.

	Men						Women				
No.	Age	Fore-head	Dorsal Region of Hand			No.	Age	Fore-head	Dorsal Region of Hand		
			Proximal area	Central area	Distal area				Proximal area	Central area	Distal area
1.	13	0.128	0.027	0.035	0.042	1.	14	0.235	0.068	0.033	0.045
2.	16	0.335	0.094	0.074	0.086	2.	16	0.081	0.065	0.055	0.049
3.	17	0.335	0.040	0.049	0.042	3.	17	0.256	0.153	0.159	0.174
4.	20	0.210	0.062	0.071	0.048	4.	18	0.083	0.072	0.030	0.083
5.	22	0.260	0.038	0.034	0.060	5.	20	0.138	0.048	0.046	0.040
6.	24	0.184	0.032	0.032	0.066	6.	20	0.257	0.175	0.240	0.127
7.	26	0.188	0.046	0.059	0.082	7.	21	0.084	0.050	0.033	0.033
8.	27	0.294	0.160	0.236	0.098	8.	24	0.281	0.175	0.198	0.290
9.	28	0.209	0.039	0.029	0.025	9.	25	0.182	0.039	0.058	0.036
10.	28	0.230	0.052	0.037	0.050	10.	25	0.117	0.103	0.099	0.043
11.	29	0.281	0.065	0.038	0.069	11.	25	0.284	0.194	0.240	0.121
12.	29	0.209	0.076	0.064	0.111	12.	28	0.092	0.026	0.038	0.028
Mean		0.238	0.061	0.063	0.065			0.174	0.098	0.102	0.089
S. D.		0.063	0.036	0.057	0.026			0.083	0.062	0.083	0.077
13.	33	0.303	0.040	0.069	0.056	13.	31	0.126	0.053	0.099	0.053
14.	34	0.132	0.042	0.048	0.070	14.	32	0.309	0.040	0.023	0.038
15.	35	0.456	0.066	0.035	0.080	15.	33	0.268	0.129	0.125	0.070
16.	37	0.261	0.059	0.068	0.126	16.	33	0.145	0.080	0.102	0.120
17.	39	0.165	0.051	0.091	0.106	17.	35	0.078	0.035	0.028	0.019
18.	41	0.149	0.064	0.086	0.076	18.	35	0.265	0.092	0.079	0.098
19.	41	0.222	0.158	0.122	0.125	19.	36	0.274	0.089	0.059	0.082
20.	42	0.243	0.043	0.032	0.030	20.	38	0.287	0.044	0.050	0.048
21.	44	0.146	0.091	0.058	0.099	21.	39	0.290	0.185	0.194	0.154
22.	44	0.333	0.147	0.157	0.146	22.	42	0.142	0.052	0.084	0.090
23.	44	0.072	0.026	0.024	0.039	23.	47	0.196	0.119	0.094	0.085
24.	46	0.146	0.076	0.043	0.055	24.	49	0.182	0.076	0.079	0.124
Mean		0.219	0.072	0.070	0.084			0.214	0.085	0.095	0.081
S. D.		0.107	0.042	0.040	0.038			0.079	0.046	0.048	0.038
25.	64	0.172	0.062	0.081	0.085	25.	70	0.132	0.101	0.130	0.081
26.	66	0.059	0.047	0.063	0.045	26.	71	0.084	0.020	0.030	0.048
27.	67	0.254	0.068	0.053	0.058	27.	75	0.242	0.087	0.052	0.094
28.	68	0.202	0.050	0.077	0.098	28.	75	0.070	0.062	0.084	0.053
29.	71	0.094	0.085	0.088	0.067	29.	79	0.275	0.067	0.040	0.185
30.	74	0.124	0.044	0.066	0.069	30.	81	0.168	0.050	0.050	0.069
31.	74	0.435	0.038	0.037	0.075	31.	83	0.172	0.043	0.046	0.039
32.	78	0.176	0.030	0.077	—	32.	83	0.168	0.033	0.098	0.062
33.	79	0.075	0.044	0.062	0.109	33.	85	0.033	0.046	0.062	0.041
34.	80	0.130	0.046	0.050	0.042	34.	85	0.257	0.042	0.092	0.039
35.	80	0.206	0.062	0.120	0.040	35.	87	0.358	0.072	0.136	0.110
36.	90	0.131	0.081	0.078	0.104	36.	90	0.193	0.048	0.090	0.039
Mean		0.172	0.055	0.071	0.072			0.179	0.056	0.076	0.072
S. D.		0.104	0.018	0.022	0.025			0.090	0.024	0.035	0.044
Grand mean		0.210	0.063	0.068	0.074			0.189	0.080	0.091	0.081
S. D.		0.095	0.034	0.041	0.031			0.086	0.048	0.059	0.055

TABLE 2. CASUAL SKIN LIPID LEVELS ON THE FOREHEAD AND THE BACK OF THE HAND IN 36 MEN AND 36 WOMEN DURING THE WINTER PERIOD.

Values represent mg. of ether-petroleum ether soluble material per sq. cm. of skin.

Men						Women					
No.	Age	Fore-head	Dorsal Region of Hand			No.	Age	Fore-head	Dorsal Region of Hand		
			Proximal area	Central area	Distal area				Proximal area	Central area	Distal area
1.	14	0.257	0.076	0.086	0.073	1.	19	0.212	0.115	0.102	0.102
2.	16	0.155	0.027	0.096	0.071	2.	21	0.256	0.107	0.064	0.102
3.	16	0.210	0.155	0.063	0.072	3.	21	0.126	0.121	0.085	0.094
4.	17	0.119	0.081	0.064	0.061	4.	22	0.190	0.063	0.063	0.059
5.	19	0.218	0.102	0.099	0.048	5.	23	0.261	0.105	0.074	0.057
6.	22	0.315	0.059	0.060	0.070	6.	23	0.282	0.141	0.131	0.123
7.	25	0.461	0.064	0.065	0.065	7.	24	0.323	0.112	0.113	0.082
8.	25	0.189	0.059	0.064	0.018	8.	25	0.360	0.053	0.057	0.038
9.	28	0.410	0.058	0.023	0.019	9.	27	0.324	0.127	0.093	0.127
10.	28	0.249	0.064	0.080	0.058	10.	28	0.199	0.075	0.076	0.047
11.	29	0.368	0.062	0.052	0.065	11.	28	0.151	0.097	0.054	0.177
12.	29	0.272	0.067	0.066	0.059	12.	29	0.125	0.099	0.074	0.107
Mean		0.269	0.073	0.068	0.057			0.234	0.101	0.082	0.093
S. D.		0.102	0.032	0.022	0.019			0.080	0.027	0.024	0.039
13.	33	0.220	0.065	0.075	0.083	13.	31	0.363	0.066	0.080	0.077
14.	37	0.354	0.113	0.149	0.127	14.	31	0.309	0.058	0.066	0.035
15.	38	0.142	0.035	0.043	0.056	15.	32	0.203	0.086	0.110	0.078
16.	41	0.289	0.098	0.041	0.065	16.	32	0.344	0.041	0.091	0.087
17.	45	0.293	0.077	0.085	0.091	17.	33	0.302	0.061	0.084	0.077
18.	46	0.403	0.075	0.105	0.078	18.	41	0.281	0.078	0.058	0.079
19.	46	0.308	0.099	0.120	0.107	19.	41	0.151	0.067	0.082	0.062
20.	51	0.245	0.043	0.056	0.046	20.	42	0.301	0.062	0.137	0.102
21.	52	0.149	0.061	0.058	0.084	21.	43	0.137	0.069	0.108	0.104
22.	52	0.188	0.044	0.108	0.106	22.	48	0.120	0.077	0.057	0.073
23.	54	0.194	0.080	0.044	0.039	23.	57	0.299	0.061	0.053	0.021
24.	55	0.192	0.076	0.074	0.077	24.	58	0.275	0.067	0.076	0.061
Mean		0.248	0.072	0.080	0.080			0.257	0.066	0.083	0.071
S. D.		0.081	0.025	0.037	0.026			0.082	0.013	0.026	0.024
25.	61	0.252	0.074	0.033	0.074	25.	60	0.252	0.139	0.198	0.160
26.	65	0.439	0.150	0.136	0.165	26.	62	0.069	0.042	0.047	0.044
27.	66	0.290	0.066	0.077	0.096	27.	65	0.252	0.049	0.054	0.051
28.	74	0.273	0.118	0.056	0.091	28.	66	0.120	0.074	0.056	0.058
29.	76	0.183	0.066	0.059	0.080	29.	72	0.041	0.018	0.007	0.016
30.	79	0.278	0.057	0.035	0.072	30.	74	0.105	0.011	0.040	0.060
31.	79	0.216	0.035	0.057	0.064	31.	75	0.118	0.100	0.082	0.088
32.	79	0.471	0.141	0.088	0.083	32.	77	0.221	0.057	0.073	0.046
33.	85	0.264	0.055	0.081	0.059	33.	79	0.423	0.020	0.021	0.022
34.	88	0.283	0.133	0.091	0.103	34.	80	0.092	0.034	0.033	0.037
35.	90	0.206	0.058	0.075	0.082	35.	83	0.205	0.076	0.050	0.053
36.	90	0.345	0.051	0.037	0.091	36.	87	0.196	0.076	0.111	0.109
Mean		0.292	0.084	0.069	0.088			0.175	0.058	0.064	0.062
S. D.		0.088	0.039	0.030	0.029			0.106	0.038	0.047	0.040
Grand mean		0.270	0.076	0.072	0.075			0.222	0.075	0.076	0.075
S. D.		0.090	0.032	0.030	0.028			0.094	0.032	0.036	0.036

TABLE 3. CASUAL SKIN LIPID LEVELS ON THE DORSAL REGION OF THE HAND (CENTRAL AREA) DETERMINED WEEKLY IN 4 MEN AND 6 WOMEN.

Values represent mg. of ether-petroleum ether soluble material per sq. cm. of skin.

No.	Sex	Age	Week					Mean	S. D.	Coefficient of Variation
			1	2	3	4	5			
1.	M	53	0.032	0.071	0.051	0.068	0.042	0.053	0.017	31
2.	M	74	0.020	0.042	0.078	0.165	0.066	0.061	0.055	91
3.	M	79	0.033	0.072	0.055	0.053	0.039	0.050	0.015	30
4.	M	87	0.050	0.063	0.068	0.065	0.125	0.074	0.042	56
5.	F	22	0.022	0.033	—	0.059	0.096	0.053	0.034	62
6.	F	24	0.045	0.036	0.049	0.067	0.100	0.059	0.026	49
7.	F	26	0.050	0.128	0.080	0.061	0.055	0.075	0.028	37
8.	F	28	0.076	0.061	0.072	0.083	0.088	0.076	0.011	13
9.	F	31	0.081	0.040	0.033	0.046	0.082	0.056	0.024	42
10.	F	71	0.030	0.024	0.033	0.047	0.062	0.037	0.016	42
Mean			0.044	0.057	0.057	0.072	0.076	0.060		
Tp. C			28	23	21	21	29			
Relative humidity, per cent			80	74	74	70	66			

TABLE 4. MEAN CASUAL LIPID LEVELS ON THE PALM AND BACK OF BOTH HANDS (CENTRAL AREAS) IN 12 MEN AND 25 WOMEN.

Values represent mg. of ether-petroleum ether soluble material per sq. cm. of skin.

	Number	Right Palm		Right Back		Left Palm		Left Back	
		Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Men	12	0.061	0.012	0.083	0.027	0.069	0.028	0.078	0.037
Women	25	0.050	0.032	0.068	0.025	0.044	0.017	0.070	0.031

for the women in the summer study; for the winter material the corresponding coefficients are +0.03 ($t = 0.17$) and −0.15 ($t = 0.89$).

As seen from tables 1 and 2 the lipid values observed in the 3 different areas of the dorsal hand region (proximal, central, distal) were usually of the same order of magnitude in the individual person. A close agreement between the mean values for the 3 areas was noted within each subgroup and for the whole groups of men and women studied. No significant difference was observed between the mean values found for the right and left hand (table 4).

A study was further made of the variation in casual skin lipid values on the back of the hand in the same subject when examined on different days. In table 3 values are reported for the casual skin lipid levels in the central area on the back of the hand for a group of 10 persons who were examined once weekly during five successive weeks. The figures

show that the casual skin lipid levels may vary notably from week to week in the same individuals.

Palm. An investigation was made in 12 men and 25 women of the casual lipid values on the palm as compared with the levels on the back of the hand (central areas). The mean values found for both the right and the left hand are presented in table 4. Although the mean lipid levels observed on the palm in all the subgroups investigated was lower than the levels on the back of the hand the differences are not statistically significant ($t = 0.22$ to 0.75).

Since no values for the casual skin lipid levels on the hands are reported in the paper by Herrmann and Prose (1) a comparison with the results obtained in the present study is not possible for this skin region.

Summary

An investigation was made of the casual skin lipid level in the region of the forehead and on the back of the hand in 72 men and 72 women between the ages of 13 and 90 years. The studies were conducted both during the summer and winter seasons. The mean lipid value observed on the forehead was 0.239 mg. per sq. cm. in the men and 0.205 mg. per sq. cm. in the women. The corresponding lipid levels on the back of the hand were 0.072 and 0.080 mg. per sq. cm.

No significant correlation was noted between age and lipid levels on the forehead. The casual lipid concentration on the back of the hand in young women was higher than in young men and in middle-aged and old women, probably reflecting a more widespread use of hand creams by young women.

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The study was supported by a grant from the Procter & Gamble Company, Cincinnati, Ohio.

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Submitted for publication March 7, 1953

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Differences in the Rate and Trend of Mortality for Different Age and Sex Groups in Different Eras

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THE outstanding effect of medical science in the past half century has been the tremendous increase in the chances for survival of the individual. The major potentials for increase in longevity have until recently mostly affected individuals in the first fifty years of life.

This situation has shown a significant alteration in the most recent decennial era (since 1940) for several reasons, especially because of the considerable gain in the treatment of infectious diseases by the relatively new chemo- and antibiotic therapies and because of more effective treatment of the malignant diseases. The benefits have been greater for the population under 50 years of age; they are now more apparent and measurable for those over 50 years of age.

The benefits to those over 50 are shown more directly by expressing the rate of mortality or survival at different ages for the different decennial eras from 1890 to 1950.[1] On the basis of percentage rates, tables and graphs can be obtained for contrast with the usual procedure of estimating the expectation of life at different ages for these eras. To the practicing physician, who has the task of treating mortal factors and prolonging life, the consideration of percentage rates and trends of mortality has more direct and useful appeal. He is accustomed to consider an entity of disease and an entity of patients with an individual disease. He estimates his successes and failures according to survival that is measurable in a limited experience and is commonly expressed in percentage and not in rates per 100,000 or in added expectation of years of life. If increments of time or age can be considered as a factor in health and mortality similar to an entity of disease, such as pneumonia, cancer of the lungs, or coronary thrombosis, a more direct, understandable, and useful picture can be presented of the changing demography of the medical population. The medical population, with which the physician exercises his calling, may be affected in the future more by the pattern of age than by the pattern of disease.

We can select any arbitrary unit of time (or age) as a factor of mortality and observe the rate and trend of survival for different age groups in different eras. The United States Life Tables (2, 3, 4, 5, 6) compiled by the Bureau of the Census provide the statistics for such analysis in this report. The figures for the white population have been used for greater accuracy. The percentage rate of mortality is simply calculated from the number recorded in the beginning of a selected unit of time and the number surviving at the end of this period. The usual method of analysis is the estimation of the expectation of life at different ages (fig. 1, 2). It has more appeal and value to the vital statistician and for obvious professional reasons to the insurance actuary.

The available tables on which some reliance can be placed are those for the year 1890, limited to the State of Massachusetts; for the decennial eras 1900, 1910, 1920, limited to the U. S. registration area; and for the decennial eras 1930, 1940, and 1949, in which the Life Tables were able to include with great-

[1] The latest published vital statistics are for the year 1949, and the figures for the era from 1940 cover the nine years to 1949. The previous eras cover a span of ten years. The Life Tables for 1950 were not published prior to the completion of this report.

Presented at the Fifth Annual Scientific Meeting of the Gerontological Society, Inc., Washington, D. C., September 5-7, 1952.

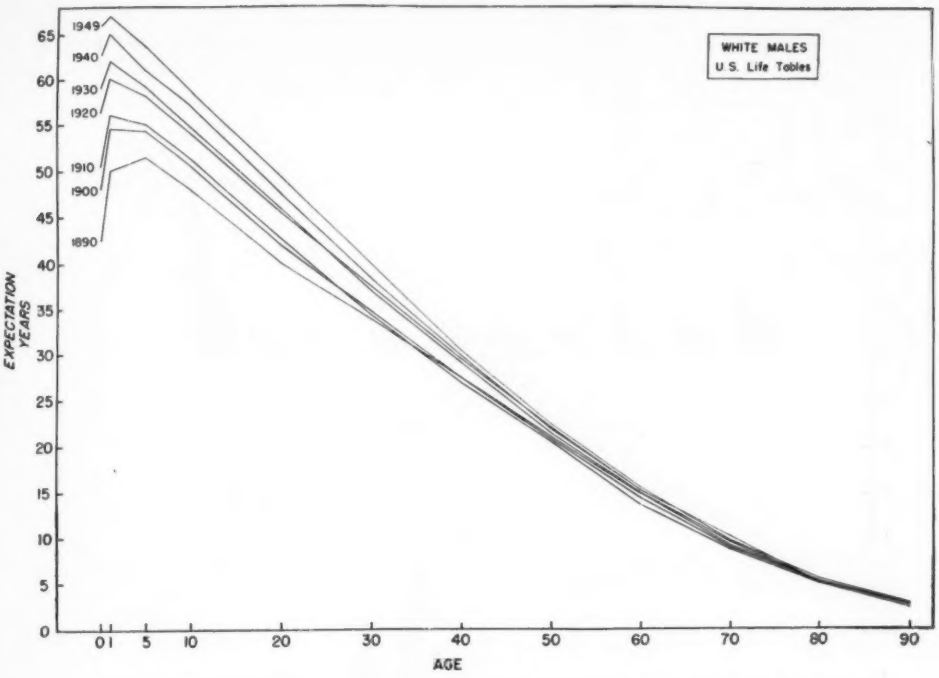

FIG. 1. Expectation of life in years for white males at different years of age in different eras.

er accuracy the entire United States. Comparison among these different eras is not entirely accurate because of the changes in the registration area and the less accurate vital statistics of the earlier eras. But the figures and graphs seem to justify the validity of the description of events so presented. It happens that these decennial census eras of 1890 to 1949 do not on the year indicated occur at a time of war.

RESULTS

I. The data[2] present certain facts (fig. 3, 4, 5, 6):

1. There has been a major increase in the rate of survival during the past sixty years. It has been most significant, as is well known, in the younger age group. In the older group over age 50, the decrease in mortality is also significant, although considerably less.

2. In the age group from birth to 5 years of age, the mortality was 25.3 per cent in 1890; by 1949 it was reduced to 3.83 per cent, 1/7 of the 1890 rate. In the age group from 5 to 10 years of age, the 1890 mortality rate was 3.63 per cent; the 1949 rate .38, or nearly 1/10 of the 1890 rate.

3. The rate of mortality for white males aged 50 to 65 years was the same in the era covering 1921-1930 as in 1911-1920. It was the same in both eras for the groups aged 65 to 75 and 75 to 85 years. The rate of mortality for white females of similar age groups did not vary between these two eras.

4. In the periods of 1930 to 1940, and of 1940 to 1949, the mortality showed a significant decrease in these older age groups, except for the white males aged 50 to 65 years.

5. The decrease has been more marked for females, especially so in the last decennial era. The rate of mortality of white males beginning

[2] Tables of data are available on request.

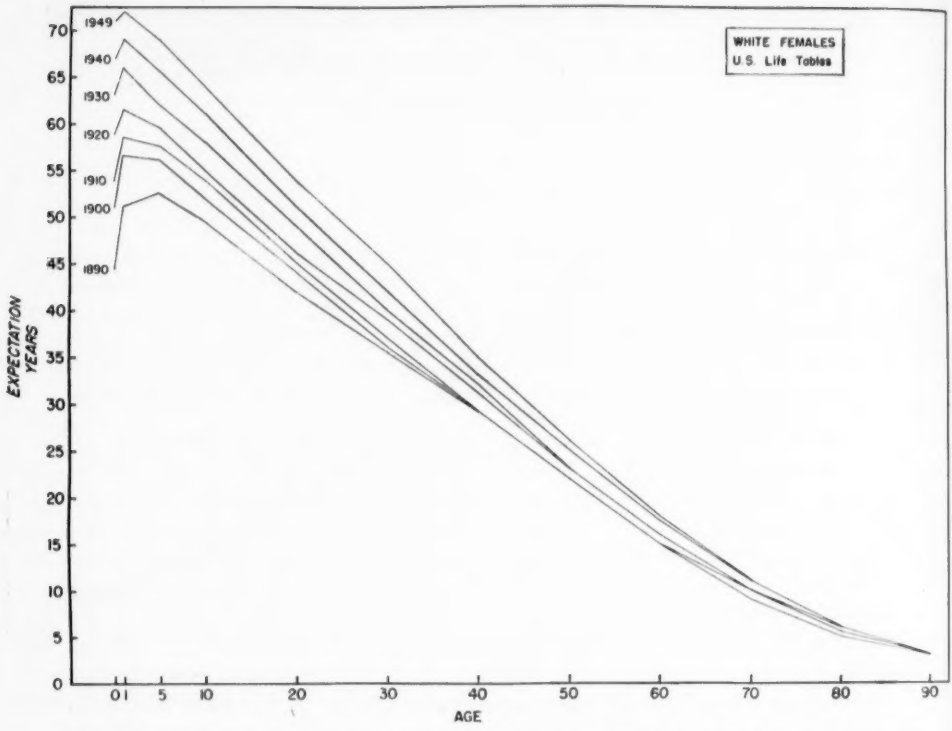

FIG. 2. Expectation of life in years for white females at different years of age in different eras.

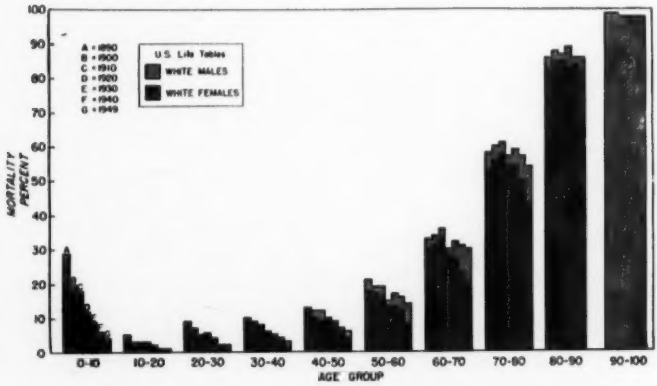

FIG. 3. Rate of mortality for white males (shaded columns) and white females (black columns) by 10 year age groups from birth to 100 years in different eras. Since the mortality rate for males is always higher than for females, it can be superimposed.

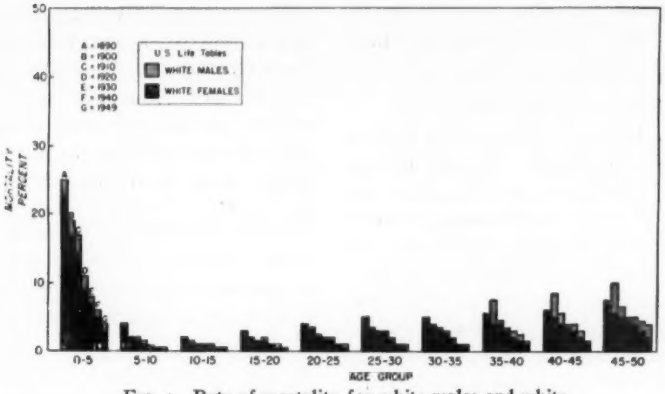

FIG. 4. Rate of mortality for white males and white females by 5 year age groups from birth to 50 years, corresponding to fig. 3.

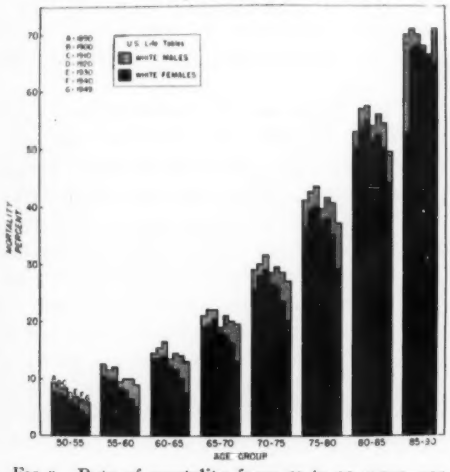

FIG. 5. Rate of mortality from 50 to 90 years, corresponding to fig. 4.

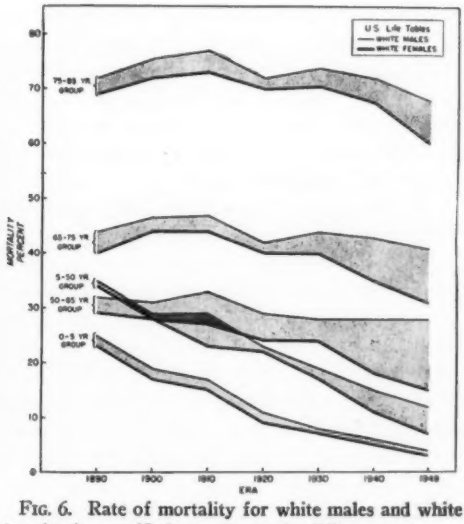

FIG. 6. Rate of mortality for white males and white females by specified age groups in different eras.

at 50 years and ending at 65 years, in 1949 was 27.7 per cent, that for white females of similar age, 15.2 per cent. The rate of mortality of white males from 65 to 75 years in 1949 was 41.3 per cent, for females 31.2 per cent. The rate of mortality of white males from 75 to 85 years in 1949 was 68.2 per cent, of females 60.1 per cent.

6. The mortality in infancy, childhood, and adolesence is now very low, below 1 per cent in the age group of 10 to 20 years. Fifty per cent of the present mortality in white males of 10 to 20 years is due to accidents.

7. Throughout the period from 1890 to 1949 a significant and constant finding is the higher survival rate of females at all ages. After age 50 this difference is of major degree.

8. The most significant mortality period for white males is 50 to 65 years of age, when cor-

onary artery disease prevails. Its toll remains unchanged or even increased, while the mortality from other diseases has decreased (1).

II. Certain effects are apparent:

1. Effects on medical education and hospital organization are suggested. In the medical curriculum, less emphasis and less time may be required for such divisions as pediatrics and bacteriology. In hospital organization, extension of pediatric services may not be warranted. The increase in the development of cardio-vascular, neurologic, and cancer services within hospitals can accompany the contrasting decline in the need for hospital services for younger individuals.

2. If aging and illness become synonymous factors, is the method of hospital care becoming too top-heavy, too complicated, and too expensive for the treatment and care of the diseases presented by the older generation, especially since the older generation now provides the greater part of the medical and hospital population? Can their treatment in some respects be reduced to office, domiciliary, nursing home, and sanitarium care?

3. Effects on the economy of the individual, of society, and of the medical profession can result, as is only too obvious, from this shift of mortality. For one interesting, although not major, example in this respect, the change in the position of life insurance examinations is characteristic. The decrease in mortality in the younger adult and early middle ages is now such that life insurance companies can dispense with medical examinations at these ages on policies of smaller amounts for economic reasons. In their experience accidents, diseases of the heart, and cancer remain as the most important causes of death at these ages. But the age-specific mortality from the last two is relatively small. The cost of insurance medical examinations have increased, especially when detailed. Insurance companies therefore have less expense with the extra mortality incurred by dispensing with medical examinations in these age groups than the total medical costs entailed in screening all applicants by medical examinations at current higher cost.

Many companies will now issue up to $10,000 of life insurance at ages under 35 without medical examinations. In some companies about 70 per cent of the ordinary life insurance policies are currently being issued on this basis, with associated decline in the insurance examination work by the medical profession. The upper limits of such policies obtained without medical examination could be even higher, based on group insurance, were it not for the consequent economic effects on the agency system of the life insurance companies.

4. The effect of the newer therapies and other factors in increasing the survival rate of middle-age and older adults may prevail only contemporaneously. As more middle-age adults become elderly adults, the mortality of the latter may increase. But the change could be only in a greater proportion of individuals living and dying at a late age without an increase in the mortality rate specific for late age.

5. The continuous development of a larger proportion of older individuals in the population is obvious. The trend of these rates of mortality indicates that survival and longevity in older individuals, or in greater numbers of individuals over 50, should continue to increase.

6. We are witnessing a significant demographic movement, in this case, not one of a shift of population in large numbers from one part of the world to another but migration across the boundaries of age. In all respects this migration is producing features that are comparable to the impact of other mass movements of population—social, cultural, economic, and political. These features are in some respects established, in other respects not yet settled, and in still others not yet evolved.

Summary

An analysis of data from U. S. Life Tables, Bureau of the Census, on the mortality of white males and females in different eras of 1890, 1900, 1910, 1920, 1930, 1940, and 1949, shows continuous improvement in survival in younger and older age groups. The specific data are summarized and presented graphically. In

the periods of 1940 and 1949, the mortality shows a significant decrease in the older age groups, except for white males aged 50 to 65 years. Throughout the periods from 1890 to 1949, a significant and constant finding is the higher survival rate of females at all ages. After age 50, this difference is of major degree.

From the Memorial Center for Cancer and Allied Diseases.

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Submitted for publication April 14, 1953

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The Prevalence of Diabetes Mellitus Among the Aged Tested in a Community Diabetes Program

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STUDIES of mortality data and hospital admissions for diabetes mellitus have clearly indicated that death rates and hospital admission rates for diabetes are higher among the older age groups than among the younger groups in the population. Since the older segment of the population is becoming larger and since it also includes those diabetics diagnosed at younger ages who live to become part of the group, it is anticipated that the prevalence of diabetes among the older segment of the population will increase.

The National Health Survey of 1935-1936 supplied information regarding known cases in the general population (8). More recently, two surveys, the Oxford Survey (10) of 1946-1947 and the Ontario Survey (5) of 1949 have provided data regarding both the known cases and the previously unknown cases in the general population. Both of the latter surveys are of relatively small populations, particularly in the older age groups. For this reason, additional data pertaining to the age distribution of diabetes, particularly if they include the older segment of the population, would seem to be of value.

Data regarding the age distribution of diabetes are available from the community diabetes control project of Dallas, Texas. This project, begun in 1950, was a joint undertaking by the Dallas County Medical Society, the Dallas City Health Department, and the U. S. Public Health Service. It was also assisted by a number of public spirited local citizens.

METHODS

The casefinding program of the Dallas Project utilized the Wilkerson-Heftmann blood sugar screening procedure (9). Subjects who were screened came from a variety of sources such as organized groups of citizens in various sections of the city who were screened in a mobile laboratory trailer, applicants for food handler's permits, individual citizens visiting the health department office for a diabetes test, and blood donors at a blood bank. No attempt was made to screen a selected sample of a cross section of the general population. The subjects were not selected on the basis of likelihood of having diabetes or by age groups except for school children below 15 years of age, who were usually excluded from the program. Venous or capillary blood was screened and, if positive, blood and urine sugar determinations were made. When indicated, glucose tolerance tests were also made. All of those individuals whose tests indicated a possibility of diabetes were classified as "suspects" and referred to their personal physicians for further evaluation.

Information was subsequently obtained from the physician as to whether the suspect did or did not have diabetes. Thus, the classification "Diabetes Diagnosed" includes only those persons who were examined by a practicing physician and diagnosed as having diabetes.

RESULTS

In the table are presented the results of the first two years of the Dallas casefinding program, in which 71,942 screening tests were performed in this community of approximately 615,000 total population. The survey includes 1,754 people between 65 to 74 years of age and 351 people 75 years old or older. Of the persons screened in Dallas, the percentage of previously known cases increased with age so that for ages 75 or more, 5 per cent were known

Revision of paper presented at the Fifth Annual Meeting of the Gerontological Society, Inc., Washington, D. C., September 7-9, 1952. Published on a grant from the Forest Park Foundation.

diabetics. The percentage who screened positive also increased as age increased. The percentages considered suspects after retest increased with age to 65 years, then decreased. This increase in percentages to 65 years with decreases after this age was also observed for those persons for whom physicians reported a diagnosis of diabetes mellitus.

These decreases after age 65 in the percentage classified as suspects and in the percentage diagnosed as diabetics may be real or may be due to some peculiarities in the data. None of these percentages have been adjusted for persons who failed to return for retests or failed to consult a physician. The proportion who failed to return for retests in the 75 and over age group was 35 per cent, twice as high as in the other age groups. There is no way of determining how this loss has affected these results.

Discussion

The results of the Dallas program and two other screening programs are presented in figure 1 and show that as age increases the prevalence of diabetes increases. The results of these surveys cannot be fully compared due to the varying types of prevalence data for each survey.

The rates for the Dallas program are the sum of the percentages for "previously known" and "diabetes suspects" given in table 1. This combination of the information corresponds most closely with the published results of the other two programs, but does not give true prevalence rates of diabetes since all persons who screened positive were not followed through to diagnosis. These rates can be examined for relative change with age.

The prevalence rates found in Oxford, Massachusetts, in 1946-1947 by Wilkerson and Krall (10) are based on blood and urine sugar determinations on 70.6 per cent of the 4,983 inhabitants of the town. In this survey, 192 people 65 to 74 years of age and 69 people 75 or more years were screened for diabetes. The rates presented in the figure were determined by including both the new cases and the previously diagnosed cases.

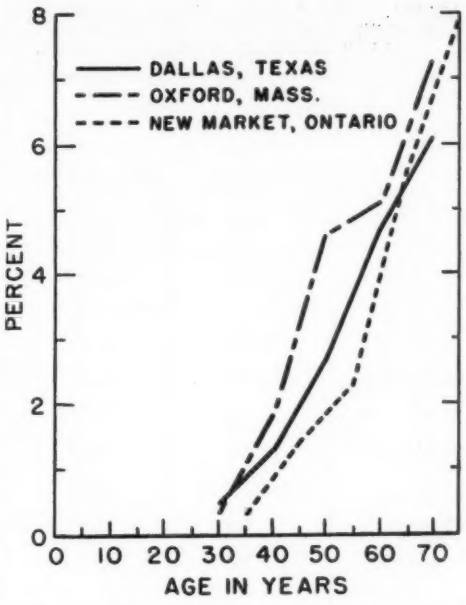

Fig. 1. Age-specific diabetes prevalence rates among persons screened for diabetes.

A survey similar to the one in Oxford was made in Newmarket, Ontario, in 1949 by Kenny, Chute, and Best (5). Approximately 4,400 persons were screened in the survey, which included 81 per cent of the town's population 6 years of age or older as well as 850 non-residents employed or attending school in the town. Blood and urine sugar determinations were utilized to diagnose the cases. Prevalence rates shown on the graph include both previously known and new found cases. The survey includes 340 people screened between 60 to 69 years of age and 195 people 70 or more years.

Other reports, (1, 2, 3, 4, 6, 7) of drives and surveys by blood or urine screening methods are available, but either do not contain sufficient data regarding the prevalence among those past the fifth decade, were of selected samples not represenative of the total popula-

TABLE 1. PERCENTAGE KNOWN, PERCENTAGE SCREENED POSITIVE BY THE WILKERSON-HEFTMANN BLOOD SUGAR TEST, AND RESULTS OF SUBSEQUENT EVALUATION BY AGE, DALLAS DIABETES SCREENING PROJECT, FEBRUARY 1950 TO FEBRUARY 1952

Age	Subjects Screened	Previously Known Diabetics	Not Previously Known Diabetics		
			Screened Positive	Suspected Diabetics After Retest	Diagnosed as Diabetics
	Number	Per Cent*	Per Cent*	Per Cent*	Per Cent*
Total	71,942	0.8	1.8	0.6	0.3
Less than 35	37,356	0.3	0.6	0.1	0.1
35-44	15,923	0.7	1.7	0.6	0.3
45-54	11,053	1.4	3.2	1.3	0.7
55-64	5,505	2.6	5.1	2.1	1.3
65-74	1,754	4.1	6.2	2.0	1.1
75 and over	351	5.1	7.4	1.4	0.6

*All percentages are based on the number screened in each age group.

tion, or information was not available regarding follow-up tests or final diagnosis.

Summary

Available data indicate that the prevalence of diabetes mellitus increases as age increases. The relative age-specific prevalence rates in the graph seem to be 0.5 per cent at 30 years of age, 4 to 5 per cent at 60 years of age and 6 to 7 per cent at 70 years of age. There are still no data from which exact age-specific diabetes mellitus prevalence rates for the United States as a whole can be determined.

It is evident that a greater proportion of the aged than of the young have diabetes. Diabetes mellitus needs emphasis in programs concerned with the health of older people. Surveys and detection drives concerned with diabetes case-finding should attempt whenever possible to reach the older person.

It is also obvious that due to the wide variation of prevalence at different ages, when results of casefinding programs are reported, the data pertaining to casefinding rates will be of greater value if presented for relatively small age groups.

The success of the Dallas Diabetes Program was due to the interest and assistance of a number of people in Dallas. In particular, Dr. Edwin L. Rippy, Chairman, Medical Advisory Committee, and Dr. J. W. Bass, Director, Dallas City Health Department, deserve special thanks and acknowledgment for their contribution to the program.

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Submitted for publication January 13, 1953

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Mechanisms of Transference and Counter-Transference in Psychotherapeutic and Social Work with the Aged

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With our rapidly aging population geriatric psychiatry has not only assumed increasing importance but has extended from the limited scope of custodial psychiatry (senile psychoses) to that of the "problem oldster" living in the community. The Old Age Counselling Service in Montreal, which was inaugurated in 1945, has been dealing exclusively with borderline problems of involution and old age (1, 2, 3). This service is a formal attempt to study the problem. However, apart from such specifically organized work, "problem oldsters" come in contact with physicians, surgeons, and social workers every day in the most varied situations. The following is an outline along which we instruct young physicians and social workers in the Gerontologic Unit about some of the basic mechanisms which come into play during case work with elderly people.

Observations

It has frequently been pointed out that mechanisms of transference are important not only in psychoanalytic and psychotherapeutic work but in every contact between physician or social worker on one hand and patient or client on the other (4, 5). As is well known, the most common transference relationship between physician and patient is that of the "parent-child" type. The fact that, in work with old people, the physician or the social worker is often considerably younger than the patient and could be the patient's child is apt to modify the common situation of transference. The following is the example of an elderly person who places the young worker into a mother role.

Mr. B. was 61 years old. His family consisted of his wife, aged 30, a daughter by his first marriage, aged 23, and three small sons aged 9, 5, and 2. The family had been referred to the agency for help with their social and economic adjustment in a new country. Very quickly a severe marital problem was revealed and consequential behaviour problems of the two older boys.

After nine months of fairly superficial contact with the agency, a 25 year old case worker was assigned to the case. Mr. B. related positively to the new worker and soon showed considerable dependence upon her, placing her in the mother role. It was noted that for the first time in his contact with the agency Mr. B. began to talk of his own mother, who was Irish and Catholic, "a very devout woman," a warm, "good mother," who took much responsibility for the children. One can presume that Mr. B.'s knowledge that his new case worker was of his own religion facilitated the transference.

In contrast to earlier behaviour, Mr. B. now began to play up his physical infirmities, giving them as the reason for requesting his worker to assume various responsibilities for him, such as arranging medical care and taking the children to clinic. He also revealed his religious conflict and said repeatedly: "I am really Catholic," although he had not practised for many years. He discussed his "temptations" including his involvement with his present wife; the rebuffs he had received because his children were Eurasian; his wife's insistence that the children should be brought up Protestant. All this was told somewhat in the manner of a six year old relating his misdoings and adding numerous excuses rather indiscriminately.

Although he was a competent, intelligent, and widely experienced man, Mr. B. sought a good deal of direct advice from the worker. In discussing the children's problems he said, "I leave it all to you," adding that the worker knew better than he about such things. This was in contrast to his behaviour towards his wife for the latter complained of his rigidity and "know all" attitude in respect to child rearing. The chief changes in Mr. B. during this period of service were: an abandoning of attempts to reinstate himself in business and thus resume the role of active head of the family and an increased dependency on the worker, which apparently gave him satisfaction and facilitated his new, more passive role in the family.

The last interview of this worker with Mr. B. was

Published on a grant from the Forest Park Foundation.

quite an emotional one, which lasted three hours, since Mr. B. resisted the worker's leaving. During the interview he talked a great deal of his early life and referred frequently to his mother. It is obvious from the case record that in spite of the preparation for the change of workers, this change implied rejection to Mr. B. During the next four months Mr. B. had two superficial interviews with the new worker and the case was then closed.

We see from this case that it was important for the workers to understand the, chronologically, paradoxical transference mechanism from the beginning. This mechanism has a positive significance. The mother role of the worker enabled Mr. B. to accept his physical limitations and to face and accept his failures. The family life became more satisfactory because Mr. B. was now able to relinquish with little frustration the dominant role which he was no longer able to fill.

In other cases the elderly patient seems to manoeuvre the person who works with him into the position of his child.

Mrs. S., a simple working-class woman of little education, was 66 years old when she came for treatment. She was referred to the psychiatric social worker because of a depression following the death of her husband. She had been crying continuously, was listless and timid. She had lost all interest in life and had only one object, to collect money for her coffin. This idea seemed to obsess her during the first weeks. She was then completely dependent and had the "feeling that I am a beggar." She cried every time she had to receive money, but at the same time she was in constant fear that the support might be discontinued.

She gradually began to talk more freely about all the difficulties which apparently worried her and she began to adopt a "motherly" attitude towards persons in the agency. She would repeatedly express concern, for example, that the staff at the social agency was over-worked and that she was too much trouble to them. She would ask if she could "do something for the folks here" or could look after them. She was given wool and knitted a few useful little things which she then gave as presents.

At one time an occasion arose when a decision had to be made about a change in her accommodation which had become unsuitable. With the responsibility of making a decision she changed again from an attitude of "mothering" the younger psychotherapist to that of a dependent child. She challenged the therapist to express loving authority. She would say: "You are my father and my mother, and all I have . . . I want to do the right thing."

Afterwards she regained her self-confidence, accepted her physical ailments realistically, and became more independent.

At first sight it seems that this woman is oscillating between the role of a mother and that of a child in her relationship with the workers and the psychologist. However, her attempts to "do things" in a "motherly" fashion for the people at the agency are only means to gain affection and approval, and the essential mechanism of the transference (in which she is the "child") actually never changes.

Equally important to understand are the numerous mechanisms of counter-transference. We have in the course of our work observed (a) disturbances in social workers due to working with aged people, (b) reluctance on the part of physicians or social workers to work with the aged, or (c) bad handling of cases due to unawareness of the problems of counter-transference.

During interviews with social workers and psychologists the mechanisms of these disturbances were studied. The following elements were observed most frequently. First, among those who work with the aged there exists invariably, to a greater or lesser degree, a mechanism of unconscious identification. The social worker, for example, who deals with old people who live in the rooming areas, receive financial relief, and are facing problems of loneliness and bereavement, becomes disturbed because her own anxiety about insecurity is activated and she sees her own future self in the client. Some of these phantasies are close to the surface and it does not take much to make the worker aware of them. However, this mechanism is quite independent of the worker's or physician's social or economic status. This is due to the fact that underneath there are, as symbols of old age, helplessness and feebleness which are much more deeply rooted and archaic and are associated with castration fear.

This brings us to the second point. In our experience, everyone who is engaged in geriatric work brings his own child-parent relationship into play. The following are brief case examples to illustrate the reaction of social workers to work with the aged:

J. M. S., aged 25, a recent graduate from School of Social Work, was assigned for two years in the Old Age Department at her own request, having had a satisfying summer placement in that department.

The worker had in childhood had a very close, warm relationship with an elderly grandmother. She came to the Old Age Department with very positive feelings towards elderly persons, felt comfortable in relationships with them, and was enthusiastic about treatment possibilities.

None of these feelings changed during the two years. However, after nine months in the department the worker began to experience quite marked feelings of depression which involved outbursts of weeping. It was noted that these feelings were never apparent while the case worker was actually interviewing clients or otherwise actively engaged on their behalf. This would support the thesis that work with elderly persons reactivates guilt involved in the worker's relationship with her parents. This worker unconsciously attempted to "make retribution" by devoting considerable extra time to the service of her clients.

A short period of relatively superficial psychotherapy enabled the worker to understand the relationship of the feelings of depression to her fantasies about her parents. However, the following year, prior to the worker's transfer to another department, she suffered another period of depression with feelings of guilt which were on a near-conscious level, since she considered, with some anxiety, whether she should not offer to withdraw her request for a transfer.

The same worker has not experienced these feelings of depression in working with younger families nor of guilt in leaving young clients.

Another worker, K. T., aged 30, was transferred to the Old Age Department with some reluctance on her part. She has received psychiatric treatment for several years; she apparently has a deep fear of her parents and considerable repressed hostility, particularly towards her father. She is customarily "sweet" and submissive towards senior people and all who represent authority.

Shortly after going to the Old Age Department she several times panicked and telephoned her former supervisor asking advice about planning with clients. Her customary themes were: "I don't understand his personality or problems at all." "What can you do for an old woman like that?"

In contrast to her behaviour with younger clients, she began to talk disparagingly of these older clients, emphasising their physcial weaknesses and inability to cope with their situations. She referred rather frequently to the need to "impose limits" in treatment and clung somewhat rigidly to "agency policy" in considering a client's eligibility for financial assistance.

About three months after assignment to the Old Age Department, the worker began to express hostility diffusely and indiscriminately in her personal and professional relationships. This consisted of bitter and unconsidered criticism and rather childish attempts to "hurt" acquaintances. These outbursts were sometimes followed by panic and remorse.

The degree to which this hostility is affecting the worker's relationship with her clients cannot be estimated at this time. That she is deriving some satisfaction or relief from working out her own relationship problems in this way seems apparent since she does not, at this time, wish to be transferred from the Old Age Department.

Few social workers or physicians are aware of this mechanism. They often harbour an unconscious feeling of hostility against the client which manifests itself in impatience or even harshness. Psychiatrists and social workers who are used to deal in a manner of detachment and patience with younger people and children are found to work authoritatively with old people and use quasi disciplinary methods. Particularly in the relationship with indigent and helpless clients the worker is frequently found to be entangled in mechanisms of unconscious domination, hostility, and guilt. It can often be seen that the physician or the worker is much less ready to accept hostility from an old patient than from a younger patient or a child.

Third, part of the physician's or worker's negative reaction is found to be due to frustration. It has been pointed out before (6, 7) that one of the mechanisms which play a role in all disturbances of later life is the fact that those factors with which we are dealing in the patient's life become increasingly more irreversible. This limits the success of all psychiatric and social work. The satisfaction of having accomplished something which provides a stimulus in our work with younger people and children is often withheld. The physician or worker is, without becoming aware of it, becoming wounded in his narcissism.

Finally, in many agencies case work with old people is given to young, inexperienced workers, or to workers who are mainly interested in and trained for administrative technical work such as financial aid and eligibility

for pensions. Moreover, those agencies who collaborate with psychiatrists use psychiatric services for young people and children, and, in the case of older people, bring the psychiatrist in only when the question of commitment or other frankly clinical problems come up.

Conclusion

From these observations the following recommendations can be made.

It is necessary that all those who are engaged in psychiatric work or psychiatric social work with the aged, particularly concerning borderline problems rather than those of organic psychoses, should be systematically instructed in the mechanisms of transference and particularly counter-transference involved in such work. These mechanisms of subtle emotional currents which are often detrimental to the success of the work have been studied in the psychoanalytic literature in settings which differ essentially from the situation described here.

The instructions to social workers and physicians (who are not necessarily psychiatrists) engaged in geriatric work should be quite specific on these points. The worker must realize that in every setting, even when there exists only an administrative problem of old age allowances, there are strong emotional currents present of which one has to be aware.

The case workers and physicians should be systematically instructed about the nature of the mechanism of transference and counter-transference in general. In particular, they should be made aware of the fact that in working with old clients a good deal of latent anxiety is apt to be precipitated in the worker and in the physician. This anxiety is frequently accentuated by the fact that the client is not only old but indigent.

The workers should be instructed about the difference between sympathy (which is most important in this type of work) and identification (which is detrimental). Moreover, the worker and physician must be aware of the fact that everybody has, in his relationship with his parents, some "unfinished problem" which is easily reactivated in one's contact with subjects of the older generation. This is the reason that currents of unconscious hostility and guilt are bound to enter into our geriatric case work. For these reasons the worker or the physician frequently encounters the aged client with unconscious anxiety which arises out of a mixture of identification ("This is myself in thirty years from now"), hostility, and guilt. The situation is made even more complex by the fact that the client, in spite of the inverted age relationship, has usually an unconscious "child-parent" relationship with the worker in which he, the client, assumes the role of the child.

Frequently the very fact that, after proper instruction, the case worker or physician anticipates these mechanisms helps the situation to a surprising degree. In many cases it is not enough that the physician or the social worker become intellectually acquainted with these mechanisms but they should also receive therapeutic support which would enable them to remove whatever is disturbing between them and their aged clients.

It would seem, from what has been described, that the work should be so departmentalized that the person who is giving technical help such as financial relief, other material support, or physical medical care should be strictly confined to this activity and not deal with the old client on a personal level. On the basis of our experience we would reject such a plan. The dynamics of psychotherapy with old people are such that manipulation of problems of everyday reality is an important part of the therapy and must be integrated with the purely psychologic aspect of the work. Therefore, it is advisable that a psychiatrist trained in geriatric work be attached to the social agency as therapist and at the same time instruct the social workers systematically in the specific aspects of this work.

Summary

In social-psychiatric case work or psychotherapeutic work with old people the situation

arises frequently that the social worker or the therapist is considerably younger than the patient. This brings up mechanisms which have hitherto been little studied. In spite of the fact that the patient frequently could be the parent of the worker or therapist, the transference situation is usually such that the worker or therapist is a parental figure.

In work with old people the psychotherapist or social worker is frequently hampered by negative counter-transference. The various mechanisms at play are presented here, and a program of systematic education of social workers and physicians is suggested.

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This work was aided by funds from the Federal-Provincial Mental Health Grants.

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Submitted for publication July 23, 1952

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The Personal Adjustment of Retired School Teachers

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THE older person about to be retired compulsorily is confronted with the fact that society no longer requires his services in its enterprises. He still needs the material goods that employment furnishes him as well as the feeling of being useful and of achieving something worth while. Assuming that gainful employment at least in part has provided such satisfactions, the retired individual will have to develop new means or adopt a new social role in order to satisfy such needs. The tremendous increase in the numbers of older people who face new adjustment problems because of compulsory retirement intensifies the import of discovering the answer to the following question: What are some of the factors associated with psychologic satisfactions in older people?

This study is in a favorable position to investigate the problem as it relates to the professional person. With teachers compulsorily retired from a large, urban center's school system, there is a group of persons who have retired because they have reached their 65th birthdays—persons who have faced and are facing new problems in achieving the psychologic satisfactions necessary for their mental health.

This research is one of several surveys of older people being carried out by the Committee for the Study of Later Maturity, Committee on Human Development, of the University of Chicago. More specifically, it is a follow-up study of a preliminary analysis of the retirement experiences of Chicago public school teachers (2, 6). While the major aim of the earlier report was to investigate how former teachers felt about their retirement, a primary purpose of this research is to elicit information about their adjustment in retirement and to discover what factors seem to be associated with good personal-social adjustment within this group.

Published on a grant from the Forest Park Foundation.

PROCEDURE

This investigation of the adjustment of teachers compulsorily retired from the Chicago public schools includes the returns of a mailing of *Your Activities and Attitudes* (4) to 1,502 former teachers. This group constitutes a stratified-random sample of the total list of compulsorily retired teachers, a list provided through the cooperation of the Retired Teachers' Association of Chicago. The sample was stratified on the basis of age and whether or not the individual had participated in our preliminary study by returning a short schedule, *A Study of Retirement*. Of the 1,502 persons to whom *Your Activities and Attitudes* were mailed, 253 were men and 1,249 were women. These numbers included all the compulsorily retired men on the list and all the compulsorily retired women over 80 years, plus a random sample of the women under 80 who had been similarly retired (1, pp. 20-23).

Schedules were returned by 120, or 47.5 per cent of the men, and, 373, or 29.9 per cent, of the women. Data which could be utilized to compare this responding group with non-respondents were supplied by the Retired Teachers' Association on *each person* in the study population; these data included age, date of retirement, and position before retirement. To supplement these data, a stratified quota sample (with one exception, a 20 per cent sample) of non-respondents who still resided in the Chicago area was contacted for interviewing. An abbreviated schedule of *Your Activities and Attitudes* was the basis for the informal interviews.

With the data from these two sources, it was possible to compare statistically participants and non-participants in this investigation

(3). Such Chi-square comparisons of the men showed one significant bias in the responding sample, viz., that respondents tended to be those who had held administrative or college teaching positions before retirement rather than those who had held elementary or high school positions. With the women, a similar situation existed: respondents tended to be secondary school and college teachers; moreover, responding women tended to be those who were under 75 years of age, hence those who had retired recently, and those living outside the Chicago area in communities under 10,000 population. Information from the women interviewees revealed that participating women tended to be native-born individuals who were in good health and were economically secure. It is important to take these sample biases into consideration when examining the results.

By the utilization of the Attitude Inventory of *Your Activities and Attitudes,* several attitude scores were established for the individuals in this study, the sum of which (the total attitude score) was used as the criterion of adjustment (5). To obtain estimates of the degree of correlation between several factors and adjustment, Pearson's coefficient of mean square contingency, corrected, was employed. One hundred fourteen of the male retired teachers' schedules were usable for this purpose, while 330 of the female retired teachers' questionnaires could be so used.

Are respondents on the whole better adjusted than non-respondents? Are the factors which cause people to respond themselves factors of adjustment? In order to determine whether or not factors of respondents are factors of adjustment the correlation between each of the selective factors and the criterion of adjustment was obtained. This procedure was carried out in an "uncorrected" group and a "corrected" sample.[1] With two exceptions, the attributes which were selective factors did not seem to be associated highly with adjustment within these groups. Self-evaluation of health and economic security (factors of sample bias among the women) did seem to be factors of adjustment also. Nevertheless, because of the size of the sample, the women's group was kept in toto for correlational purposes.

Thus, techniques just outlined have been utilized in order to determine the representativeness of the responding samples. With such information it was possible to proceed with confidence toward the major purpose of the study, viz., to determine important areas of behavior that are associated with good adjustment in the later years.

Knowledge of factors which contribute to the happiness of this professional group would seem to be useful for programs in preparation for retirement and in the improvement of retirement policies and procedures.

Results

The coefficients of contingency showing the relationship between certain attributes and the adjustment scores are shown for men in table 1 and for women in table 2. As seen in table 1, the range of coefficients for the men is from .17 (number of friends of the same sex during the teens) to .73 (attitudes toward friends); the maximum coefficient is a portion of the total attitude score and therefore contributes to it proportionately. Disregarding the sectional attitudes scores (shown in the tables by parentheses), as well as the total activities score, the range is from .17 to .57 (the latter the security-activities score). Still not considering the sectional attitude scores, almost one-half of the coefficients are in the .40's, one-third being from .40 to .44. Not all of these were statistically significant, however. The 4 coefficients which were above .50 were significant; they dealt with a security score (which included the question on employment status), number of symptoms, self-rating of health, and frequency of reading the Bible or prayer book. The higher coefficients among the men's group were from correlations within

[1] By random selection, the responding sample was made to represent the total study population on the attributes which revealed sample biases; this representative group was the "corrected" group. The total responding sample constituted the "uncorrected" group. This entire procedure is explained fully in (1).

TABLE 1. COEFFICIENTS OF CONTINGENCY CORRELATING CERTAIN ATTRIBUTES WITH TOTAL ATTITUDE SCORES FOR 114 RETIRED MALE SCHOOL TEACHERS

Attribute	C_{cor}	Attribute	C_{cor}
Present Age	0.44*	Economic Security:	
Health:		Economic position	.43**
		Permanent security	.30*
Self-rating of health	.53**	Security (activities) score	.57**
Number physical problems	-.42	Attitudes toward security	(.57)**
Minor difficulties	-.21		
Nervous troubles	-.56**	Religion:	
Activities health score	.45*	Church membership	.34**
Attitudes toward health	(.71)**	Frequency attend services	.40
		Frequency listen to radio church services	.49**
Family:		Frequency read prayer book	.50**
Frequency see family	.23	Belief in after life	.44*
Happiness in marriage	.35	Religious (activities) score	.42
Attitudes toward family	(.63)**	Attitudes toward religion	(.56)**
Friends:		Earlier Life:	
Frequency see young friends	.33	Feeling toward mother	.27
Intimate contacts (activities) score	.41	Feeling toward father	.27
Attitudes toward friends	(.73)**	Number friends same sex	.17
		Number friends opposite sex	.27
Leisure:			
Number leisure activities	.36	Mobility:	
Number hobbies	.42	Economic	.49*
		Geographical	.39
Organizations:			
Number clubs belong	.45	Others:	
Number offices	.28	Evaluation of life	.43*
Frequency attend meetings	.32	Feelings of usefulness	(.67)**
Clubs - leisure (activities) score	.44**	Feelings of happiness	(.71)**
		Total activities score	0.63**
Employment:			
Employment status	.45**		
Attitudes toward work	(.63)**		

*Significant at the 5 or 2 per cent level.
**Significant at the 1 per cent level.

the areas of security, health, religion, employment, and economic mobility, still excluding those contingencies of attitude scores.

In summarizing the coefficients for the women, a similar picture was found. Excluding the sectional attitude coefficients, the range was from two of .13 (one of these dealing with employment status, the other with the number of friends of the same sex during the teens) to .51, happiness in marriage. (N in this latter case included only the one-third or so who had been married.) All of the women's coefficients which were .30 or greater were statistically significant. Of those coefficients .40 or greater, one dealt with health, two with leisure activities and clubs, and one with economic mobility.

Within the group of men, reliable statistical relationships were demonstrated between adjustment scores and the several areas of behavior covered by the hypotheses. The areas are:

1. Health, as shown by number of nervous symptoms, self-rating on health, health (activities) score.

2. Leisure activities, as shown by the leisure (activities) score—which involved items concerning recreational activities, as well as club activities.

TABLE 2. COEFFICIENTS OF CONTINGENCY CORRELATING CERTAIN ATTRIBUTES WITH TOTAL ATTITUDE SCORES FOR 330 RETIRED FEMALE SCHOOL TEACHERS

Attribute	C_{cor}	Attribute	C_{cor}
Present Age	0.26	**Economic Security:**	
Health:		Economic position	.41**
		Permanent security	.38**
Self-rating of health	.48**	Security (activities) score	.30*
Number physical problems	-.43**	Attitudes toward security	(.50)**
Minor difficulties	-.33**		
Nervous troubles	-.45**	**Religion:**	
Activities health score	.49**	Church membership	.21**
Attitudes toward health	(.69)**	Frequency attend services	.38**
		Frequency listen to radio church services	.25
Family:		Frequency read prayer book	.36**
Frequency see family	.25	Belief in after life	.32**
Happiness in marriage	.51**	Religious (activities) score	.35**
Attitudes toward family	(.63)**	Attitudes toward religion	(.49)**
Friends:		**Earlier Life:**	
Frequency see young friends	.28	Feeling toward mother	.19
Intimate contacts (activities) score	.32*	Feeling toward father	.26
Attitudes toward friends	(.63)**	Number friends same sex	.13
		Number friends opposite sex	.19
Leisure:			
Number leisure activities	.28*	**Mobility:**	
Number hobbies	.27*	Economic	.41**
		Geographical	.21
Organizations:			
Number clubs belong	.37**	**Others:**	
Number offices	.42**	Evaluation of life	.28**
Frequency attend meetings	.31**	Feelings of usefulness	(.69)**
Clubs - leisure (activities) score	.43**	Feelings of happiness	(.72)**
		Total activities score	0.50**
Employment:			
Employment status	.13		
Attitudes toward work	(.64)**		

*Significant at the 5 or 2 per cent level.
**Significant at the 1 per cent level.

3. Clubs and organizations, as shown by the leisure (activities) score.

4. Work, as shown by present employment status and the security (activities) score, which also involved items on economic security.

5. Economic security, as shown by the security (activities) score, economic position and permanent security.

6. Religion, as shown by the frequency of reading the Bible or prayer book, the frequency of listening to radio church services, belief in after life, and church membership.

7. Economic mobility, as shown by the economic mobility score. In addition to showing the importance of these factors in the adjustment of men teachers in retirement, the data show reliable relationships between the quality of adjustment and the ages of men and between present adjustment and the teacher's evaluation of his happiness.

With the women, similar attributes seem to be related to personal adjustment. The data show reliable associations between adjustment scores and factors in the following areas:

1. Health, as shown by number of nervous troubles, self-rating on health, health (activities) score, number of serious physical problems, number of minor physical difficulties—virtually all of the coefficients on health.

2. Family relationships, as shown by hap-

piness in marriage, intimate contacts (activities) score, which involved also contacts with friends.

3. Friendships, as shown by the intimate contacts (activities) score.

4. Leisure activities, as shown by the leisure (activities) score which also involved club activities, number of hobbies, and number of leisure-time pursuits.

5. Clubs and organizations, as shown by number of offices in clubs, number of clubs belonged to, leisure (activities) score, and frequency of attending club meetings.

6. Work, as shown by security (activities) scores, which also involves items on economic security.

7. Economic security, as indicated by economic position, permanent security, and security (activities) score.

8. Religion, as shown by frequency of church attendance, frequency of reading the Bible or prayer book, religious (activities) score, belief in an after life, and church membership.

9. Economic mobility, as shown by the score on economic mobility. With the women, too, there is a statistically significant relationship between ratings of happiness and the quality of adjustment.

With regard to the correlations of sectional attitude scores with the total attitude score (those shown in parentheses, tables 1 and 2), the rank order for both men and women was similar. For the men the rank order from low to high was as follows: religion, security, work, health, feeling useful, and happiness. The correlation of the total activities score with the total attitude score resulted in a slightly higher contingency value for the men than for the women.

Discussion

It is believed that reliable relationships are demonstrated by the contingencies mentioned above, as shown within the specific groups of men and women, and that all those coefficients which are statistically significant do show reliable associations because the criterion used is a *composite* score, being made up of several category scores on different, fairly independent areas of attitudes. In discussing this composite criterion, the authors of *Your Activities and Attitudes* indicate that adjustment in one particular area is not necessarily associated with adjustment in other areas or with the total of adjustment (5, pp. 133-134).

On the other hand, reliable relationships in the areas of earlier life and geographic mobility have not been demonstrated in this study. Contingencies with data in these areas were low and positive and possibly due to chance.

For the most part, these data concerning factors of adjustment reveal great similarities between the male and the female retired teacher groups. Judging by the magnitude and reliability of the contingencies, certain variations do occur; but with regard to the factor *areas* the groups are quite analogous. However, one or two differences do stand out between the men and the women. For example, the contingency on employment status, shows that quite significant for favorable adjustment of the men teachers was employment in some kind of work ($C_{cor} = .45$, P being .01); being gainfully employed was not reliably important for the adjustment of the women ($C_{cor} = .13$, P being .90). This undoubtedly relates to the traditional social roles of men and women in American society. The middle-class man usually is a gainfully employed worker—the family breadwinner; the woman, if she be employed, must usually play a dual role, including her traditional one as the homemaker. On retirement, however, the man loses his former useful role as the breadwinner who was preeminently occupied with his profession; the woman who is retired still has the useful function in the keeping of the home. Apparently, for the retired woman teacher gainful work no longer is a necessary part of her adjustment pattern, while it remains an important source of psychologic satisfaction for the man.

One other variation is worth noting—again related to the duality of social role played by the working woman. Items on the schedule concerning club and organizational activities

and intimate contacts seemed to be more significant in the adjustment of the women than with the men. It may be that these men retired teachers never have been very active participants in clubs and organizations, being concerned more with their profession than with organizations outside the school. Throughout her teaching career, the woman teacher seems to have performed the additional role of the middle-class woman who has duties at home, obligations to participate actively as a club member, with important friendships in those clubs and organizations. Hence, these areas of activity continue as significant factors in their psychologic adjustment in later maturity and old age. The men, who have had more years of professional preparation than the women, seem, then, to have counted on their work more fully than on organizational activities for sources of personal satisfaction.

Summary

This research has been concerned with the analysis of correlational data from contingency tables in order to determine the factors of good and poor adjustment of retired public school teachers. The criterion of adjustment was the total score on the Attitude Inventory of *Your Activities and Attitudes*. The author set out to demonstrate the existence of certain relationships within the group of 114 men teachers and 330 women teachers (whose schedules were usable for this purpose), having taken into account the biases discovered within the responding groups. The coefficients of contingency revealed that reliable associations exist between the criterion and characteristics in these areas of behavior: health, family, friendships, leisure activities, work, economic security, religion, and economic mobility.

It seemed that family, friendships, and club activities were more important to women than to men; engagement in some kind of work seemed to be a more crucial factor of the adjustment of the men than of the women. The implications of these last facts in relation to counseling and guidance programs and to adult education in preparation for retirement are significant.

To the woman compulsorily retired after a career, later life would seem to present fewer adjustment problems than it would to the man. The retired woman can continue in the areas of homemaking and club activities — areas which are sources of psychologic satisfaction to these women, at least. The retired man, on the other hand, would seem less likely to have readily available means to assure for himself the psychologic satisfaction necessary for his mental well-being. This would imply that either job opportunities in harmony with his interests and abilities, real or potential, be provided or that significant substitute activities be arranged which would supply the individual opportunities to be useful and to feel worth while in his own right. This is essential not only in terms of individual personality adjustment but for the mental health of our society at large.

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Submitted for publication June 24, 1952
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The Cornell Medical Index-Health Questionnaire:

VI. The Relation of Patients' Complaints to Age, Sex, Race, and Education

KEEVE BRODMAN, ALBERT J. ERDMANN, JR., IRVING LORGE, AND HAROLD G. WOLFF

PHYSICIANS recognize the relation of patients' complaints to disease but are not always as keenly aware of the association of symptoms with biologic and sociologic influences. This paper reports a study of the relation of patients' complaints to age, sex, race, and education.

SAMPLE AND METHODS

The sample studied consisted of the 5,119 adult out-patients admitted to the New York Hospital (a general hospital cooperating with Cornell University Medical College) who, in the year beginning July 1, 1948, completed a Cornell Medical Index-Health Questionnaire (CMI). Of these patients, 2,107 were males (1,980 whites and 127 Negroes) and 3,012 were females (2,796 whites and 216 Negroes).

The CMI, a four-page self-administered questionnaire, collects a large body of extensive medical and psychiatric data corresponding to that elicited in a detailed general medical history. Data collected with the CMI are as accurate as those gathered in oral interview (1) and yield correct comprehensive general medical (2, 5) and psychiatric (3, 4) diagnostic evaluation of patients.

The 195 items of data collected with the CMI (144 in sections A-L refer to the body, and 51 in sections M-R refer to moods and feelings) were compared according to the patient's age, sex, race (white or Negro), and education. Comparisons were by items individually and by items grouped according to whether they referred to the body or to moods and feelings. The critical level of statistical significance used was 3 σ.

RESULTS

The relation of complaints to sex of individual.—Table 1 shows that women expressed more complaints than men, both in complaints referring to the body (an average of 21 by women and 15 by men) and to moods and feelings (an average of 5 by women and 2 by men). This is true in all age groups, as shown in figure 1.

TABLE 1. THE AVERAGE NUMBER OF COMPLAINTS ON THE CMI REFERRING TO THE BODY AND TO MOODS AND FEELINGS: BY SEX AND RACE

Subjects	Average Number of Complaints			
	Body		Moods and Feelings	
	Male	Female	Male	Female
White	15	21	2	5
Negro	19	23	4	5
Total	15	21	2	5

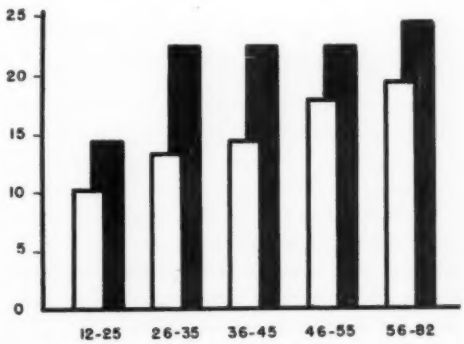

FIG. 1. The median number of bodily complaints on the CMI, of men (clear areas) and of women (solid areas), for 5 age groups. Horizontal values are the ages of the groups, vertical values are the median number of complaints.

The number of white patients is sufficiently large to permit comparisons by individual items. Of the 138 items concerning bodily complaints which are identical for the two sexes, women listed 70 significantly more often than men. By contrast, men marked only 6 items significantly more often than women. These 6 are: a history of bloody diarrhoea, a history of venereal disease, being underweight, having had a serious injury, smoking more than 20 cigarettes a day, and taking two or more alcoholic drinks a day. The results of this statistical analysis are in accord with clinical experience that women generally express more medical complaints than men, except for complaints similar to the 6 listed.

The number of disorders diagnosed during hospital examination were compared according to the sex of the patients. Both men and women had the same number of diagnosed illnesses, an average of 1.7 per patient (table 2). In each age group men and women had a similar number of diagnosed ailments. The larger number of complaints made by women is thus not associated with a larger number of recognized disorders.

TABLE 2. THE AVERAGE NUMBER OF HOSPITAL DIAGNOSES PER PATIENT: BY SEX AND AGE

Sex	Years					Total
	12-25	26-35	36-45	46-55	56-82	
Male	1.4	1.7	1.6	1.8	2.1	1.7
Female	1.5	1.6	1.8	1.9	2.0	1.7

Women more often than men claimed to have specific diseases not recognized on examination. For example, women claimed to have peptic ulcer one-and-a-half times more often than did men, although peptic ulcer was diagnosed four times more often in men; and women claimed to have arthritis four times more often than did men, although arthritis was diagnosed with equal frequency in both. Examining physicians thus could not always rely on the accuracy of historical data elicited from a patient.

Women also more often than men complained of a family history of specific disorders. Obviously, diseases do not occur with greater frequency in the families of women than in those of men. Of the 13 items of family history on the CMI, women significantly more often than men claimed the following 9: heart disease, stomach trouble, arthritis, headaches, nervous exhaustion, worrying, nervousness, excessive shyness, and nervous breakdown. There is indication that women overclaimed, rather than men underclaimed, the items of family history. These claims of family illnesses by women were associated with women often asserting that they themselves also had the same illnesses or their symptoms. In all 9 instances of overcomplaining about family illnesses, women significantly more than men claimed to have the symptoms of the disorders, and in all except heart disease claimed to have the disorder itself.

The relation of complaints to age.—Older men and women made more complaints referring to the body than younger. Age and the number of bodily complaints are correlated significantly. This is in accord with clinical observation that as individuals grow older, developing more disabilities, they complain more about their bodies. In each successive age decade patients had an increasing number of bodily complaints, as shown in figure 1. For women, the sharp increase in the number of complaints concerning the body at the 26 to 35 decade (fig. 1) is not associated with a corresponding increase in the number of diagnosed disorders (table 2).

For moods and feelings, on the other hand, older men and women made essentially the same average number of complaints as did the younger. For both men and women, age is therefore not significantly correlated with the number of complaints of moods and feelings. The fact that individuals of different ages had the same average number of complaints concerning moods and feelings suggests that for each sex the incidence of emotional disturbance in different age groups was similar.

A study of the relation of age to responses to each of the 195 items individually showed that for many items pertaining to the body older patients made the complaints more often than did the younger. Thus, older men significantly more often than younger complained of 27 items regarding the body (19 per cent of bodily items), and older women significantly more often than younger complained of 25 (17 per cent of bodily items).

In contrast, for only a few items did older patients complain less often than younger: 2 for men (a history of jaundice, and biting the nails badly), and 7 for women (a history of jaundice, biting the nails badly, arthritis, a family history of arthritis, weak and painful feet, pains in the back, and being tense and jumpy with menstrual periods). It is not surprising that older people are found to complain less than younger of these ailments. Jaundice and biting the nails are common in childhood and often forgotten in adult life; musculoskeletal symptoms in women are usually most troublesome in the middle years of work, childbearing, and childrearing, and the memory of the dysmenorrhoea of early life is likely to be dismissed later, especially after the menopause.

The analyses revealed that as women grew older, complaining less of arthritic symptoms and of arthritis, they less frequently claimed a family history of arthritis. Similarly, older women complained more than younger of headaches and more frequently claimed a family history of headaches. These examples again illustrate that at all ages the women studied gave a family history to correspond with their own complaints and that the family history a patient gives is associated with, and must be evaluated in reference to, the symptoms which the patient claims.

The relation of complaints to race.—Negro women recorded more complaints on the CMI than did Negro men (table 1). Negroes had only a few more complaints than did whites of the same sex. Indeed, when the 195 items are considered one at a time, the percentage of whites and Negroes of the same sex who made any complaint is not significantly different.

The relation of complaints to education.—Younger patients had more education than older. As in most United States groups studied, the average number of years of education of the younger men and women in the sample studied was greater than that of the older group. To determine the relation of education to the number of complaints, the influence of age must therefore first be equated.

Partial correlations were derived among age, education, and the number of complaints on the CMI. After eliminating the influence of age, the number of complaints was not significantly correlated with education. Thus, although more educated patients checked fewer bodily complaints than did the less educated, analysis of the data showed that the more educated made fewer complaints because they were younger and not because of their longer schooling.

Discussion

The CMI permitted collection of a large body of comparable data from thousands of patients, an impossible task with conventional medical interviews. The reliability of data collected with the CMI having been confirmed by oral interview (1), the data analyzed in this study are statements of what patients believe to be their true medical histories.

This investigation indicates that in the patients studied, the pattern of medical complaining is similar in all age groups, suggesting that the psychologic determinants of medical complaining are set by adolescence.

The habit of medical complaining by women is common in our culture. The fact that women in this sample made more complaints regarding moods and feelings than did men and more bodily complaints without more diagnosed disorders, suggests that women had a higher incidence of emotional disturbances than did men. Because some patients overcomplained about many aspects of their medical histories, even about a history of past and of family illnesses, all items of medical histories needed evaluation in terms of the patients' emotional status. Physicians caring for these patients

often neglected to make such evaluation, sometimes when it was crucial (2, 4).

Summary

Data collected with the Cornell Medical Index-Health Questionnaire from 5,119 adult New York Hospital patients were analyzed. Comparison of the data according to the age, sex, race, and education of the patients revealed that: older men and women made more bodily complaints than younger, but a like number of complaints of moods and feelings; women had more medical complaints than men, although both had the same average number of diagnosed disorders; Negroes listed only few more complaints than did whites of the same sex; length of schooling was not related to the number of medical complaints. The data indicate that medical complaints should be evaluated in terms of the patient's age and sex as well as of organic and emotional disorders.

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Sample copies of the Cornell Medical Index-Health Questionnaire may be obtained from the authors, the New York Hospital, 525 East 68 Street, New York 21, N. Y.

This work was performed under a contract, recommended by the National Research Council, between the Veterans Administration and Cornell University Medical College.

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Submitted for publication January 9, 1953

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Recommendations for Psychiatric Care in a Home for the Aged

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THE Home for Aged and Infirm Hebrews of New York is a modern, adequately equipped and staffed institution with two principal residence facilities in which 857 persons reside and which provides special care for 63 others who live in their homes. Each of the two units has hospital facilities for all care, except major surgery and the custodial care of chronic psychoses.

Up to three years ago formal psychiatric medicine was practiced in the Home by consultant specialists who advised as to the management and disposition of patients whom they saw on emergency call. A part time psychologist was also available to test questionable applicants, assay the condition of residents, and investigate the psychology of aging. Three years ago a psychiatrist was made available on a part time basis to handle urgent cases and to devote his remaining time where psychiatric judgment indicated it could be of greatest value.

From this start the psychiatric team at the Home has been enlarged. It now consists of a consulting psychiatrist, 3 attending psychiatrists who devote a total of ten to fifteen hours a week to the Home, 1 full time psychiatric social worker, 2 part time psychologists, and 1 part time secretarial assistant. The preexisting Social Service Departments, Occupational Therapy Department, and Department of Rehabilitation and Physical Medicine have always subserved many psychiatric functions; in addition they now give specific assistance to the Department of Psychiatry as required. The increase in the psychiatric staff was in response to needs previously recognized but unsatisfied because of the absence of psychiatrists sufficiently interested in the aged and of funds to support such a program.

With the advent of such aid it has become clear that a home for the aged needs a psychiatric team and that psychiatrists can find interesting problems in a home. In this setting a psychiatrist serves many useful functions: he acts as consultant to the medical staff in the traditional manner; he helps formulate policy on admissions and assists the Social Service Department in the evaluation of applicants; he interprets to the staff the meaning of disordered behavior of residents and he teaches the staff the importance of their own personalities as instruments of psychotherapy. In the performance of these routine institutional duties he is at the same time actually pioneering in the area of mass and individual psychotherapy for the aged.

One of the most important functions of the psychiatrist seems to be the translation of the experience of those who have so long worked with the aged into a language which can communicate to others the goals and methods of successful care of the aged. This institution has long had a successful physical and mental hygiene program for its residents which developed over the years on an empirical basis. Only within recent times has the non-medical staff begun to appreciate that the results of their endeavors can be categorized and formulated as psychiatric care and treatment (4, 5).

DIAGNOSIS AND MANAGEMENT

The availability of psychiatrists for diagnosis has made possible the differentiation of transient psychoses from more chronic states and has decreased the number of transfers to institutions for the mentally sick. The time of transfer for many others has been put off for weeks, months, or years because of staff cooperation,

Read in abbreviated form at the Fifth Annual Scientific Meeting of the Gerontological Society, Inc., September 6, 1952, Washington, D. C.

under psychiatrists' supervision, in the management of emotionally ill aged. Solutions have been provided to obscure problems which otherwise would have been the subject of prolonged investigation and excessive expense; the establishment of safeguards for residents and staff has been made possible by the early discovery of possible dangers. In short, better medical management and treatment have been made possible by intensive psychiatric study.

In addition, psychiatric diagnosis has at times revealed when additional neurologic investigation of patients was required. During the past year, two cases referred because of disordered behavior were found to have brain tumors and were transferred to the Neurosurgical Service, Mount Sinai Hospital, where the diagnosis was confirmed at operation.

The Institution as Psychotherapeutic Agent

Aged persons enter a Home because they have lost resources: mental, physical, social, or economic. The Home is an attempt on a grand scale to provide a social and physical environment where these losses may be recouped. To the psychiatrist it becomes obvious that each member of the staff in the performance of his routine duties is also engaged in psychotherapy. The helplessness and anxiety of the aged, which we see as a dependent state, results in the elevation of each staff member to the status of a surrogate parent. These substitute parent figures, by and large, do an excellent job of psychotherapy as it is attested to by the successful adaptation that most aged people make in the Home.

What specific measures or attitudes, arrived at intuitively, through experience or through training, are effective, and how they work is a question the psychiatrist would like answered in detail. Failures in this intuitive psychotherapeutic functioning must occur, and not infrequently, because of anxiety and hostility aroused in staff members by the aged, especially those with disordered behavior. This indicates the need for psychiatric education of personnel toward understanding of emotional illness and toward understanding of their own emotional responses. In this way over-reactions which interfere with best resident care may be eliminated or controlled.

At times the staff must be reconciled to failures. One cannot expect to do more for the aged with psychoses, neuroses, or personality disorders than is possible in younger persons simply because the patient has grown old; in the other hand, one need not anticipate that one can do less. The multifactorial etiology of behavior disorder in the aged must be clarified for staff members. How psychologic predisposition, loss of general physical and particularly cortical-intergrative resources, in a setting of socio-economic deprivation, combine to make the individual feel helpless and anxious must be stressed if the staff is to be alert to the general medical, nutritional, and social factors which can be used in treatment and prophylaxis.

Above all, staff members require gentle introduction to some basic psychodynamic facts. They must be helped to see that a person whom we know how to understand feels loved, that understanding a person requires an appreciation of those motives which the patient masks for himself and others but which, when known, make clear the connection between seemingly unrelated aspects of his behavior. Response to the emotional needs revealed by these "hidden" motives constitute understanding the patient and can be effective therapy even when the staff is incapable of providing direct gratifications.

The educational program, including regular staff conferences, has led to healthier attitudes in the part of staff members, eased their management of routine behavior problems, and thereby increased the comfort of the residents. To a large extent this has occurred through the decreasing of anxiety on the part of personnel with respect to psychiatric problems as their information is increased. Such staff conferences have also improved the cooperative handling of both full blown and incipient or threatening management problems (1).

The attitude of staff members has great in-

fluence on how patients are sent to the psychiatrist, which patients are referred, and on the amount of pressure for continuation or cessation of their treatment. This, too, needs cooperative staff examination especially because there are involved a number of medico-legal questions, the legal aspects of which are often forgotten unless an administrator takes part in the psychiatric orientation program.

Psychotherapeutic Techniques

Individual psychotherapy has been directed along lines indicated by observation of which techniques were successful in the mass psychotherapeutic effort of the Home. The aged with disordered behavior have not been considered good candidates for formal individual psychotherapy because of their loss of memory, their physical frailty, the few years remaining to them, and the seemingly ominous nature of their mental symptoms. They are not usually eager to accept and rarely have the cortical resources to deal with "uncovering" or "insight-giving" techniques; they are preoccupied with somatic failures and are resentful of their helpless dependent status. Their sense of vulnerability distorts their view of the world so that it is seen as a harsh and hostile place and they respond to it with fear or anger. They would like to have their environment bettered and at their late age are not greatly interested in changing themselves, a viewpoint not unique to old age and for this very reason, perhaps, usually well entrenched in old age. Recalling the few years the aged have left, psychiatrists have usually conserved efforts; custodial care, environmental manipulation, and symptomatic treatment of somatic complaints have more often than not completed the range of treatment offered. The psychotherapeutic effect of such care is taken for granted. As already noted, we need to study this and sift from the mass psychotherapeutic functions of a home the effective maneuvres to consolidate, improve, and add to them.

In the Home for Aged and Infirm Hebrews, out of observation of what succeeded, there has been crystallizing a brief-session, spaced-interview, role-playing type of psychotherapy. The available time for psychotherapy has made possible active treatment of from 10 to 15 patients per week. This brief method of treatment promises to be effective. Our results have been incorporated in a separate communication (2).

The Selection of Applicants

Applicants to a home for the aged are usually selected in terms of the need of the applicant for the home and the suitability of the home to gratify those needs present and those likely to develop. Each home preferably admits mentally hale persons who can make good social adaptations. Residence in a home is a venture in communal living wherein aging persons may find congenial groups in addition to physical care as required. As those admitted age further and their social adaptability decreases, more and more aberrant behavior is forgiven and more and more care is provided—up to the point of chronic psychosis or drawn out acute organic brain syndromes. The very existence of this psychiatric program proves that facilities expand to meet needs.

Then the home is faced with the question of where to stop. Shall we admit persons who have already reached the stage of many of the residents whose psychiatric status has declined since admission? The facilities are there; shall we encourage a change in the nature of the home? This can be answered if we evaluate our study of success with those admitted hale who have declined and if we see that addition of facilities and the development of psychotherapeutic techniques can help rehabilitate some of these people..

We are studying our residents to determine whether it has been possible to maintain in the Home for Aged and Infirm Hebrews, through the availability of psychiatric aid, patients who in the past had to be transferred to other institutions or to some other type of care, or who left the home of their own volition. We must study the course of applicants admitted in relation to the prognosis made at the time of acceptance. We have already learned (3, 6) that once-psychotic patients are not necessarily bad

risks, that certain people who seem self-reliant are poor risks, that certain fearful and nervous persons who seem questionable may do very well in the institution as it now exists. There are bodies of data to be culled from actual case study which will improve selection as institutional care expands in response to community needs.

The screening of applicants has already decreased the burden of the social workers while at the same time it has assisted in selecting candidates most likely to profit from and fit into the Home.

Conclusions and Recommendations

As psychiatry is made more available in the Home for Aged and Infirm Hebrews, it becomes obvious that investigation is necessary along three interdependent lines: the development of psychotherapeutic techniques; understanding and improvement of the empirical mass psychotherapeutic effort which constitutes a great part of the total effort of the institution; and analysis of admissions toward improved selection of applicants and modification of psychiatric reasons for rejection. Such investigation proceeds almost automatically as routine psychiatric care is provided.

Over a three year period, medical nursing and social service departments with the assistance of a part time psychiatrist have explored the need for psychiatric care and tested the efficiency of several types of psychiatric help. Over the past eighteen months this program increased as noted above. This investigation has included diagnostic examination of the residents, education of the staff, the screening of applicants, individual psychotherapy of the residents, and a group psychotherapeutic program of three and a half months. They have resulted in the following tentative conclusions:

1. There is a sufficient number of emotionally disturbed (non-psychotic) patients constantly present in the population of the Home to occupy a full time psychiatrist.

2. The type of work and attitudes of patients and staff, as well as the quasi-experimental types of psychotherapy used, are such as to make the participation of more than one psychiatrist, each on a part time basis, more productive than using one psychiatrist full time.

3. Experimentation with therapy indicates that a brief-interview technique (five to fifteen minutes per patient) at relatively infrequent intervals (once a week or less often) may effectively decrease the patient's suffering, increase social adaptability, and ease the problem of management in over 50 per cent of the patients referred for treatment. It has also become apparent that psychiatric treatment has been a means of handling acute psychotic episodes so that transfer to other hospitals has been less frequent than in the absence of such treatment. In addition, many chronically psychotic patients on the basis of this treatment have managed to continue residence in the institution, whereas in the absence of such treatment, transfer to a mental hospital would have been imperative. Whether or not this expenditure of time and effort is justifiable needs further study.

4. Review of the case material and examination of the attitudes of resident staff physicians, nursing, supervisory, and social service indicates the need for a group orientation program for new residents, organized along psychiatric lines, a) to provide emotional support for newly admitted patients in their transitional period, appropriate information as they may require it, specific reassurance from time to time, and b) to contribute a foundation of morale on the basis of growth of interest in other residents and an encouraged dependency upon the staff and "institution."

5. There is a need for infirmary bed space and an auxiliary staff for the management and specific treatment of acutely disturbed patients ranging from transitory acute delirious episodes to full-fledged but transitory and treatable so-called "endogenous psychoses," as well as for the more chronic behavior problems.

6. One of the most important responsibilities of the psychiatrist is the indoctrination of the staff with healthy attitudes in reaction to the aged persons who come under their care, in view of the almost universal tendency to re-

spond with anxiety and hostility to the effects of aging and the problems of aged persons.

7. The investigation of psychotherapeutic procedures warrants the following conclusions: a) special and specific modifications of psychiatric technique, the majority of which are probably yet to be worked out, are needed for the provision of adequate psychiatric care of the aged; b) it is possible with modifications of well-known psychiatric procedures to achieve good results in restoration of social functioning in aged people who might otherwise be considered candidates merely for custodial care or restraining measures.

The present program indicates that routine psychiatric care is as essential for the comfort, well-being, and protection of residents as is general medical care.

This research was supported in part by the Esther and Joseph Klingenstein Research Fund.

The author wishes to express his gratitude to Dr. Frederic D. Zeman, Medical Director of the Home for Aged and Infirm Hebrews of New York, for his wholehearted cooperation and sound advice, to Dr. Jack Sheps and Dr. Elias Savitsky, on whose experiences in psychotherapy in the Home some of these conclusions are based, and to Mrs. H. Turner for her general assistance.

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Submitted for publication December 17, 1952

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Some Problems of Experimental Design in Studies of Aging

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The Scope of Aging Studies

Aging studies are concerned with a description of the temporal changes in structure, composition, and function of organisms under various environmental circumstances. The utilization of such information in studies of maximal effective life span is obviously a practical problem of considerable human importance.

Strictly speaking, aging may be said to begin at the time an organism becomes a separate new entity. In ordinary usage, however, the word "aging" has been applied specifically to the phenomena occurring during the phase of deterioration of function of organisms. It is important to note that those changes may be determined by earlier events. Involutional changes occur with age under "optimal" as well as sub-optimal experimental conditions. It is improper to exclude or ignore either type of condition.

What is an Optimal Condition

In many statements about nutrition it is implicitly assumed that "maximal" and "optimal" are equivalent terms. Obviously this need not be correct. If, as is well known, life span may be inversely correlated with body weight under specific conditions, one should reserve the use of the term optimal to conditions favoring some over-all desirable result. A diet producing maximal growth is not optimal in a general sense. One can look for those conditions which promote maximal fertility, et cetera. The desired end must be specified. It may be that the achievement of the best possible dietary compromise for rapid growth rate and long life span would be sought as optimal. As the science of nutrition becomes more firmly grounded it becomes increasingly necessary to relate numerous variables among environmental conditions to a number of end consequences, each important to the real life situation. This approach is, of course, not new but it is emphasized because the consequences of its neglect become obvious when one finds contrary effects on two desirable ends from a given condition.

Experimental Design and Interpretation

a) The number of uncontrolled (uncontrollable?) variables.

It is axiomatic that in order to obtain a simple and reliable answer to a scientific question, such as that of the role of a particular environmental factor on the expected length of life, one must set up a study in which all determining factors except that one are held constant and it alone is varied. Unfortunately, in experiments involving the study of animals over a lifetime, even as short as two years, as in the mouse, in which daily exposure to laboratory workers occurs, it is inevitable that there will be exposure in a more or less random fashion to a variety of environmental effects, ranging from infection with pathogenic microorganisms to simple fright from human handling. In our laboratories in one strain of mice a type of epilepsy occurs precipitated by handling the animals in connection with weighing. In other strains under apparently identical conditions this phenomenon has not been seen. In the affected strain the convulsions do not occur frequently in multiple-caged mice, but only when caged singly. In this case an environmental variable is crucial to the results in one strain of mice and not in others.

The variety of the diseases from which supposedly identically treated mice from highly inbred stocks die is an indication that random, or systematic, but unknown, factors are entering into the experimental set-up. The great differences found between minimum and maximum length of life in a group of mice treated alike point to the same conclusion.

Such considerations, and others, point to the need for (1) simultaneity of observations in the several groups of animals to be compared, (2) handling of animals by the same individual or individuals, (3) littermate distribution throughout groups, (4) the use of independent criteria of strict comparability, such as equal frequencies of deaths from various causes not specifically related to the variables under study, and (5) accurate information as to the cause of death in every animal in life span experiments and specific information regarding the diseases from which each individual animal may be suffering in shorter term experiments. Finally, (6) it seems imperative that there be repetition of complete experiments to reduce the likelihood that unknown determinants fixed the answers obtained. In principle, the large number of possible uncontrolled factors which may not operate equally in all groups of animals in long term experiments makes it essential that extreme caution be

Read as part of a paper in a Symposium on Aging, Federation of American Societies for Experimental Biology, New York, 1952

used in setting up the design of aging experiments and in interpreting their results.

b) The interrelation of variables.

Various diseases attack animals at different times of life. The susceptibility of an animal to one fatal disease need not be related to its susceptibility to another. Therefore it becomes improper to conclude anything about the effect of diet A upon susceptibility to disease X if disease X occurs late in life and the animals on diet A have died early in life from a disease Y, unrelated to diet. Situations like this occur.

The evaluation of the influence of changes in various components in a diet offers serious difficulties when several components affect the same ultimate metabolic mechanism. The interrelations of vitamin E, vitamin B_{12}, choline, methionine, and perhaps other constituents of the diet is a case in point. The problem becomes even more complex if a component has two or more functions, not all of which are shared by the second or other components which influence one function in common.

c) The significance of controls and controlled conditions.

In aging studies the concepts of "controls" and of "controlled" conditions have special significance. In order to have a control for a particular variable it is not essential that all other variables be controlled so long as it can be justifiably assumed that all of the other variables either (1) affect the control and the experimental group equally, or (2) have negligible effects. Neither of these assumptions is automatically justified in aging studies. Much confusion has resulted from ignoring this fact.

The necessity of extensively controlled conditions in aging studies brings with it the concomitant necessity to restrict the range of possible justified conclusions. No set conclusions from scientific data can be completely valid except over the range of conditions actually studied. Generalizations as to the effects of age *per se* on chemical composition of organs, for example, should wait until studies have been made under a considerable variety of conditions. It may easily turn out that changes observed may be due to a specific condition and not be a universal effect of aging. This is said, not to minimize the importance of strictly controlled conditions, nor of the data obtained under particular conditions, but simply to warn against premature generalization.

Finally the necessity for controlled conditions in aging studies does one further thing. It predisposes students to employ diets and other environmental circumstances far removed from natural ones. Mice do not ordinarily eat casein, lard, dextrose, synthetic vitamins, purified minerals, etc., all in fixed and constant proportions. Neither do they naturally live in small metal cages, subject to periodic insult by the gentlest of handling by humans,—to them fantastic giants. The results one may find under more natural environmental conditions may easily be quite different. One of the urgent needs of research on aging is to design experiments to test the effects, if any, of the unnatural elements in the more conventional controlled experimental situations.

Submitted for publication February 24, 1953

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An Evaluative Comparison of the Three Editions of Cowdry's Problems of Ageing

A Special Book Review

THOMAS S. GARDNER

A critical examination of progress in any field of research is advantageous in that a comparison of the relative rates of development in different phases of the over-all problems will sometimes point out weaknesses in the program. Such weaknesses may sometimes be corrected and their bases determined.

Cowdry's *Problems of Ageing*, 1939, 1942, and the third edition edited by Lansing, 1952, (2) will be

analyzed to determine the progress in the separate phases and divisions of aging research. The three editions are an excellent criterion for this purpose as they are the major cooperative contributions to the field ever published and have served as unifying forces in thinking and working in aging research. An examination of the three editions shows that the second edition was more a labor of love than necessity. The improvements of the second edition over the first are minor and primarily consist of a few extra chapters added on phases left out of the first. However the third edition is justified on the basis of time elapsed between the second and third—ten years—and the rapid advances in some aspects of the aging problem.

In order to fulfill the purposes of this evaluation the breakup into three main divisions by the third edition, as described in the tables, will be followed with only minor changes.

The determination of the rate of progress is by comparison of the date and number of the references cited between the publication date of the second edition, 1942, and the third edition, 1952. The survey carried out in each chapter of Cowdry's *Problem of Ageing* is remarkably complete in each edition to that date. Occasional exceptions due to oversight of work published and personal biases of the authors can never be entirely eliminated in a comprehensive treatise of this nature. Therefore it is valid, in my opinion, to consider the third edition as a signpost indicating where we are today and pointing in which direction we are going unless deliberate attempts are made to shift the incidence and direction of programs contemplated and underway in the various laboratories.

The physical make-up and arrangements of all three editions are excellent and the authors well selected for their specialized fields of interest.

The first and second editions will be considered as a unit with the second edition as the base line for comparison with the third. The most noticeable difference between the first-second editions and the third is that pathways of investigations are discussed in the first-second editions but are not mentioned in the third, *in spite of the fact that these problems have not yet been investigated!* The second edition is, therefore, a richer "suggestive" source for research problems than the third. In this respect the second edition must supplement the third for the investigator.

In table 1, *Biologic and Cellular Problems of Aging,* we note a slowing down of research work in this division. The authors in the third edition write as if they may be considering the biologic and cellular attack on aging as a lost cause. The enthusiasms of the previous editions have not been carried over into the third. However I agree that it was unnecessary to reproduce the background material on aging in plants, insects, etc. deleted from the third edition. The only field that shows progress is in general physiology, and Lansing has done an excellent job in summarizing various advances in this aspect.

We must assume that cytologic and histochemical investigations in aging research are slowing to a halt. It was unnecessary to repeat MacNider's chapter. Even McCay exhibits some despondency in his otherwise usually enthusiastic approach to the aging problem in nutrition. If we were to judge the whole aging field by this section we could only conclude that research in this field is grinding to a halt and in about ten years would be at about the same level of activity as it was twenty or thirty years ago! The nature of Dublin's chapter will always indicate progress on a percentage basis due to the nature of mortality statistics—without any effect on the research angle of the problem. The inclusion of Dublin's chapter in this division is by grace rather than by reason.

An examination of table 2, *Clinical and Organic Problems of Aging,* tells a far different story. Marked progress is taking place in several phases of this division. Special interest in the cardiovascular system is apparent. Research on atherosclerosis and arteriosclerosis is actually being conducted at a greater rate and intensity than even table 2 indicates. It is interesting to note that the arthritic diseases were not treated, yet they present a major problem in geriatric medicine.

Publications indicative of the vast strides in the field of clinical and organic problems of aging are the monthly journals devoted to geriatrics and may be included as having direct application to this division. *Geriatrics,* and the *Journal of the American Geriatrics Society* primarily report advances in treatment of the various syndromes of the aged, while journals such as *Circulation, American Heart Journal,* etc. report advances in research in the various phases of this division. However it is only fair to point out that this second division has a very large potential source of research men in the medical field, far larger than the biologic fields.

Some phases of this division seem neglected, e.g., skeleton, urinary system, eye, and some of the glandular systems such as the thyroid. The assumption that we know everything about these fields is unjustified. It is to be hoped that interest will be rekindled in many of the topics that show a decrease of interest.

Table 3, *Social, Economic, and Psychologic Aspects* does not do justice to the enormous strides made in these fields, especially social, during the past ten years. However the table does indicate that interest has increased and the percentage values for published work in certain fields are very encouraging. During the past ten years the public has become aging conscious in regards to the economic and social phases. The psychiatric and psychologic phases have lagged to some extent, and there seems to be an unspoken belief that if the economic and social problems are

TABLE 1. BIOLOGIC AND CELLULAR PROBLEMS OF AGING.

Title and Author	Chapter Number in Edition			Edition III		
				Total No. References	References Dated 1942 and After	
	Ed. I	Ed. II	Ed. III		Number	Per Cent
Ageing in Plants. W. Crocker	1	1				
Senescence and Death in Protozoa and Invertebrates. H. S. Jennings	2	2				
Ageing in Insects. L. O. Howard	3	3				
Ageing of Vertebrates. T. W. Todd	4	4				
Human Cultural Levels. C. Wissler	5	5				
Longevity in Retrospect and in Prospect. L. I. Dublin	6	6	7	2	2	100.0
General Physiology. A. I. Lansing			1	110	70	63.6
Ageing of Tissue Fluids. E. V. Cowdry	23	23	2	31	8	25.8
Ageing of Individual Cells. E. V. Cowdry		24	3	92	1	1.1
Ageing Processes Considered in Relation to Tissue Susceptibility and Resistance. W. deB. MacNider	24	25	4	20	0	0.0
Quantitative Histochemical Changes in Ageing. O. H. Lowry and A. B. Hastings		27*	5	54	17	31.5
Chemical Aspects of Ageing and the Effect of Diet Upon Ageing. C. M. McCay	21*	26*	6	185	40	21.6

*Titles in third edition used if earlier editions vary.

solved most of the psychologic problems would automatically correct themselves. Few have dared to carry this thought to the logical conclusion, that if the biologic problems of aging are ever solved the social, economic, and psychologic problems become the same as for the younger age groups!

In a treatise such as Cowdry's third edition it would be unreasonable to expect emphasis on the third division as discussed here. The people to whom the book is directed are primarily interested in the biologic and clinical sides of the problem. The people doing the most work in the social phases often do not consider themselves scientific or medical investigators but as social workers. Thus several state committees on aging discuss almost wholly the social and economic aspects. A popular monthly magazine, *Lifetime Living*, edited by Gumpert, has been quite successful with practical approaches to the solution of social and economic aspects of the problem.

Radio, television, newspapers, and magazines carry a large number of programs and articles on the sociologic and economic, and even the psychologic, attacks on the aging problems.

The National Conference on Aging held in Washington, D. C., in August, 1950, devoted 10 sections to the various sociologic problems and only one to the medical and research problems. Over 800 delegates attended with about 50 in the single medical and research section. It is evident where the public interest lies. *Aging*, published by the Federal Security Agency, seems to be wholly devoted to the sociologic problems. Therefore it is true that due to the growing number of workers in these fields this particular division will increase rapidly in importance, knowledge, and utility. Is this exploding interest in the sociologic and economic fields of aging due to a belief of fatalism and the attitude of pessimism among the biologic investigators? Is this belief justified? Apparently so. Lansing, editor of Cowdry's third edition, has this to say in his introduction: (4)

> On the whole I believe that a spirit of pessimism is present in many of the chapters. Dr. Cobb urges caution

TABLE 2. CLINICAL AND ORGANIC PROBLEMS OF AGING.

Title and Author	Chapter Number — Edition			Edition III		
				Total No. References	References Dated 1942 and After	
	Ed. I	Ed. II	Ed. III		Number	Per Cent
Ageing of the Nervous System. M. Critchely J. L. O'Leary	17	19	8	42	19	45.4
The Eye. J. S. Friedenwald	18	20	9	33	3	9.1
The Ear. S. R. Guild W. P. Covell	19	21	10	60	40	66.7
Cardiovascular System and Blood. A. E. Cohn	7	7				
The Heart and Great Vessels in Old Age. P. D. White			11	17	13	76.5
Hematologic Values in the Aged. J. B. Shapleigh, S. Mayes and C. V. Moore			12	33	11	33.3
Arteriosclerosis. J. M. Steele			13	50	35	70.0
Experimental Hypertension. W. S. Hartroft			14	253	144	56.9
The Thyroid, Pancreatic Islets, Parathyroids, Adrenals, Thymus and Pituitary. A. J. Carlson	13	15	15	68	0	0.0
Cytological Changes in the Cells of the Pituitary, Thyroids, Adrenals and Sex Glands of Ageing Fowls. F. Payne			16	8	7	87.5
Homeostatic and Histochemical Aspects of the Endocrine Glands. E. W. Dempsey			17	33	23	69.7
Ageing of Homeostatic Mechanisms. W. B. Cannon N. W. Shock	22	22	18	196	91	46.6
Teeth and Jaws. H. B. G. Robinson, L. R. Boling and B. L. Lischer Robinson and Boling		13	19	123	43	35.0
Digestive System. A. C. Ivy Ivy and M. I. Crossman	9	10	20	211	54	25.7
Lymphatic Tissue. E. B. Krumbhaar W. Andrew	8	8	21	100	30	30.0
The Respiratory System. C. C. Macklin and M. T. Macklin In the Aged. H. A. Bickerman		9	22	153	98	64.0
Age Changes in Renal Function. N. W. Shock			23	26	17	65.3
Urinary System. J. R. Oliver	10	11	24	28	2	7.2
Female Reproductive System. E. Allen W. H. Masters	14	16	25	74	22	29.8

TABLE 2. Continued

Title and Author	Chapter Number in Edition			Edition III		
				Total No. References	References Dated 1942 and After	
	Ed. I	Ed. II	Ed. III		Number	Per Cent
Male Secondary Sexual Organs. R. A. Moore		18	26	80	11	13.7
Male Reproductive System*. E. T. Engle	15	17	27	37	14	37.8
Metabolism of Avascularized Tissues and Changes Associated with Ageing. J. E. Kirk and P. F. Hansen			28	124	51	41.1
Ageing of the Skin. F. D. Weidman Z. K. Cooper	12	14	29	54	31	57.4
Skeleton, Locomotor System and Teeth. T. W. Todd W. M. Cobb (skeleton)	11	12	30	96	6	6.3
Ageing from the Point of View of the Clinician. L. F. Barker	25	31				
Diagnosis, Prophylaxis and Treatment in Old Age. A. Mueller-Deham		32				
Surgical Problems in the Aged. R. Elman			31	12	6	50.0
Anesthesia in the Aged. E. Apogi			32	23	23	100.0
Degeneration and Regeneration. W. B. Kountz			33	62	42	67.8
Cancer and Ageing. J. A. Saxton			36	42	30	71.5

*Different title in second edition.

in interpretation of many of the almost classical views on ageing of the skeletal system; new data are slow in appearing. Dr. Bickerman summarizes a wide variety of diseases of the respiratory system associated with ageing and finds that the situation is confused. And so it goes.

Research on the biology of ageing is almost at a standstill. There is hardly a handful of workers in this area today. Our population is rapidly becoming an old population. There is a sense of urgency in attacking the so-called degenerative diseases which take such a heavy toll of mature and elderly adults. It may be that the sources of funds for research are supporting clinical and allied research on ageing to the effective exclusion of biology. This may be an unwarranted suspicion; it is equally possible that were more funds available for gerontology, all areas of research, including biology, would flourish.

The editors (1) of the *Journal of Gerontology* also concur in this belief. They point out the facts that papers received are too often non-observational and that young investigators are not going into gerontologic research as a primary activity. Insufficient material in biologic research to fill the quarterly issues of the Journal come in. This is in contrast to the large number of articles on geriatrics, which today has expanded to two monthly journals.

If this continues, by 1960 research in the biologic problems of aging will have practically disappeared. However there is a strong probability that industry eventually will take up biologic research work in aging if the universities and foundations fail to pursue the field. In order to progress in any field trained and interested men with the right mental attitudes toward the field under investigation, money, and reasonable time are required. There is a dearth of trained men in the field and perhaps a new orientation is needed. An orientation toward a solution of the problems already recognized would be of help (3). However an air of pessimism is more often encountered than a forward-looking viewpoint.

More money, if used in improperly directed research, cannot make up this deficit of mental outlook. Time can be condensed only by having more men and more projects underway. In any case the outlook is not favorable and on this basis another edition of Cowdry's *Problems of Ageing* is not recommended for at least ten years so that something pertinent

TABLE 3. SOCIAL, ECONOMIC, AND PSYCHOLOGIC ASPECTS.

Title and Author	Chapter Number in Edition			Edition III		
				Total No.	References Dated 1942 and After	
	Ed. I	Ed. II	Ed. III	References	Number	Per Cent
Psychological Aspects of Ageing. W. R. Miles	20	28				
Psychological Guidance for Older People. G. Lawton		29				
Changes in Personality and Psychosexual Phenomena with Age. G. V. Hamilton	16	30				
Social Urgency for Research. E. J. Stieglitz		33				
Cosmetological Aspects of Ageing. M. Chieffi			34	34	14	41.2
Rehabilitation for the Chronically Ill and Aged. H. A. Rusk and E. J. Taylor			35	12	12	100.0
Trends in the Ageing Population. P. M. Hauser and E. Shanas			37	21	18	85.7
The Older Worker in Industry. R. K. Burns and L. B. Brown			38	90	73*	81.5
Roles and Status of Older People. R. J. Havighurst			39	3	3	100.0
Personal Adjustment in Old Age. R. S. Cavan			40	15	12	80.0

*Three references undated and assumed to be before 1942.

can be reported instead of rewriting old material. It might even be better to have progress reports instead of a treatise, and these reports could be put out every five years in the same manner as the host of annual reports for many other fields. Also it would be better to eliminate the sections on sociologic, economic, and psychologic aspects of the aging problem unless a complete book doing justice to the rapid progress in those fields is issued. Trying to put all problems into one volume has resulted in necessary slighting of the sociologic and related fields.

Summary

An analysis of the three editions of Cowdry's *Problems of Ageing* clearly shows that research in the biologic and cellular aspects of aging has fallen behind work in the clinical, organic, sociologic, and related fields.

A few specific recommendations in aging research and future publications of this nature are made based on the analysis presented.

References

1. Anon. *J. Gerontol., 3:* 141-142, 1948.
2. Cowdry, E. V., *Problems of Ageing,* Williams & Wilkins, Baltimore, (a.) first ed., xxx, 758 pp. 1939; (b.) second ed., xxxvi, 936 pp. 1942; (c.) third ed., edited by A. I. Lansing, xxiii, 1061, 1952.
3. Gardner, T. S., Gerontotherapeutics, *Scient. Monthly, 72:* 189-191, 1951.
4. Lansing, A. I., in Cowdry's *Problems of Ageing,* vii-viii, cf. ref. 2-c.

Submitted for publication March 18, 1953

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Training in the Dental Aspects of Gerontology

FRED HERZBERG

THE increase in the life expectancy of individuals due to improved economic circumstances, advances in public health, wider acceptance of medical treatment, improved hospital and clinic facilities, and because of the vast strides made by medical science, has given us an older population. In 1945 ten million people in the United States were 65 years of age or older (9). It has been predicted that in the future this number will increase even more.

With further increases in age of larger numbers of people we may expect to have an increase in medical and related problems, the appearance of new disease entities, and the exacerbation of disease incidence in already known diseases. Problems of disease control and alleviation will appear in new forms.

Just as the medical profession is gradually becoming more conscious of the need for consideration of the problems of the aging, so will the related professions need to become more aware of these problems. This report is concerned with one aspect of the problem of aging, viz. the recognition of the problem in the training of dentists.

It is the purpose of this study to review the publications of the several dental schools in the United States with a view to determining the degree of recognition now being given to problems of aging, in so far as the publications reveal this.

To the end described above, the recent catalogues of the recognized dental schools of the United States (1) were reviewed. The 42 catalogues were distributed as follows in terms of year of issue:

Year of Issue	*Number of Schools*
1949-1950	1
1949-1951	1
1950-1951	4
1950-1952	1
1951	1
1951-1952	22
1951-1953	2
1952	1
1952-1953	9
TOTAL	42

It was found that 7 schools (16.6 per cent) had courses which seemed to take cognizance of the existence of the problem of aging by including, in their descriptions of one course each, some reference to senility, age, geriatrics, or similar word or expression.

Each of the 7 schools indicating a reference to aging did so in a different course of instruction, as follows: Anatomy, Oral Histology and Embryology, Periodontology, Public Health Dentistry, Educational Psychology for Medical Personnel, Physiology, and Human Dentition. The course descriptions deemed to relate to aging read as follows (italics by the author):

Anatomy: "Special dissections, study of anomaly and variations, and of *age changes in the body.*" (2).

Oral Histology and Embryology: "A complete survey of the human mouth, showing the stages of development in chronological order from infancy throughout life, including the senile changes which affect the attachment of the dental processes." (3).

Periodontology: "Continuation of junior course, with shift of emphasis to the *oral phase of geriatrics.*" (4).

Public Health Dentistry: ". . . students are informed of their community responsibility and the *effect of social change* on health practice." (5).

Educational Psychology for Medical Personnel: "The course begins with a brief survey of human capacities, abilities, interests, individual differences and total development *throughout the life span.*" (6). (This course is given for dental hygienists, but not for dental students.)

Physiology: "Growth, development, and function of the structural mechanism of the human face from *birth to senescence.*" (7).

Human Dentition: ". . . it should be looked upon as something which *changes with time,* i.e., the developmental approach is important in understanding the clinical problems of dentistry." (8).

Of the above courses the ones in Oral Histology and Embryology, Periodontology, Physiology, and Human Dentition may be considered to relate more or less directly to gerodontology. The remaining 3 courses are more general in character, and of these, 1 is given for hygienists but not for dental students.

SUMMARY

A study of the catalogues of the 42 recognized dental schools in the United States reveals that 7 schools, in an equal number of different courses, make some reference to gerontology. Of these, 4 make reference to gerodontology. One course description uses the word "geriatrics."

It is not meant to imply that other courses in these schools do not consider problems of aging, or that schools making no reference to the problem in their course descriptions might not nonetheless teach varying aspects of the subject of aging. This report is only concerned with signs of recognition of the

problem in course descriptions as stated in the catalogues of the schools. It is assumed that more frequent reference is made in descriptions of courses of instruction to matters considered important than to matters considered casual to the training of a dentist. To this degree the recognition of aging in course descriptions has some significance.

It is concluded that the signs of recognition of the problems of aging, in dental terms, are just beginning to be observed in the training of the dentist.

References

1. American Dental Association, Council on Dental Education, *Accredited Dental Schools*, Feb., 1952.
2. Baylor University, College of Dentistry, Catalogue, 1951-1952, p. 25.
3. Buffalo, University of, School of Dentistry, Catalogue, Feb. 1951. p. 17.
4. Iowa, State University of, College of Dentistry, Catalogue, 1952, p. 15.
5. Michigan, University of, School of Dentistry, Catalogue, 1952-1953, p. 49.
6. Ohio State University, College of Dentistry, Catalogue, 1952-1953, p. 404.
7. Oregon, University of, Dental School, Catalogue, 1951-1952, p. 41.
8. Pennsylvania, University of, School of Dentistry, Catalogue, 1951-1952, p. 32.
9. Williamson, W. R.: Budgeting for Social Security, *J. Gerontol.*, *1*: 60-71, 1946.

Submitted for publication March 23, 1953

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CURRENT COMMENT

Institute on Aging

Approximately 260 people attended the second "Institute on Aging" held on the Washington University campus, April 17 and 18, 1953. The opportunities and problems facing the aging were discussed by St. Louis community leaders and by national experts in geriatrics and gerontology.

The two-day program was sponsored by several divisions of the University: the School of Medicine, George Warren Brown School of Social Work, School of Business and Public Administration, and University College (the adult education division). The following community organizations also shared sponsorship: Metropolitan Church Federation, Social Planning Council, Adult Education Council, and the Mental Health Association of St. Louis.

Major addresses were delivered by Dr. Robert A. Moore, Dean of the School of Medicine; Clark Tibbitts, chairman of the Committee on Aging and Geriatrics of the Department of Health, Education, and Welfare; Wilma Donahue, chairman of the Division of Gerontology of the University of Michigan Institute for Human Adjustment; and Milton L. Barron, Professor of Sociology and Director of the Nation-Wide Study of Retirement, Cornell University. Rev. Paul V. Maves, Drew Seminary; and Ewan Clague, Commissioner of Labor Statistics, United States Dept. of Labor also had prominent parts in the program.

Four general sessions for all participants and six sectional discussion meetings which ran simultaneously and met both Friday afternoon and Saturday morning made up the program. An Exhibit Room displaying the hobbies of retired people received much attention and highly favorable comments.

Many of those attending believed the highlight of the institute was the program of four six-minute talks by "representative senior citizens." These gentlemen—ranging in age from sixty-eight to eighty-three—had the audience alternately laughing and then experiencing extremely penetrating insights into the matter of aging enjoyably and gracefully. Their remarks were specific, significant, and interesting. Perhaps these talks and the success of the Exhibit Room demonstrate the value of getting senior citizens themselves to take greater part in similar institutes on aging.

Willis H. Reals, Dean of University College, and Frank L. Wright, Chairman of the Dept. of Education, were in charge of the Institute. Key local people who helped make the two-day program an outstanding success included: E. V. Cowdry, Research Professor and Director of the Wernse Laboratory for Cancer Research; Dr. John E. Kirk, Associate Professor of Medicine; Albert I. Lansing, Associate Professor of Anatomy; Dr. William B. Kountz, Assistant Professor in Clinical Medicine; Dr. Edwin F. Gildea, Professor of Neuropsychiatry; Dr. William H. Masters, Associate Professor of Obstetrics and Gynecology; Dr. Robert E. Shank, Professor of Preventive Medicine; Dr. Dean F. Davies, Assistant Professor of Biochemistry; Margaret Hickey, Editor of the Public Affairs Department of the *Ladies' Home Journal;* Marion Bunch, Chairman of the Department of Psychology; Dr. David Littauer, Executive Director of the Jewish Hospital of St. Louis; T. L. Gaukel, Manager of the St. Louis Bureau of Old Age and Survivors Insurance; Mrs. William B. Kountz, Gerontology Chairman, Missouri Federation of Women's Clubs; Rev. O. Walter Wagner, Executive Director of the Metropolitan Church Federation.

A number of other Washington University faculty members, as well as labor leaders, social workers, and personnel managers from St. Louis also played important roles as panel members in discussion sessions.

Copies of the proceedings of the Institute on Aging, April 17 and 18 at Washington University, consist of approximately 60 pages paper-bound. They are available at one dollar per copy by writing to University College, Washington University, St. Louis 5, Missouri.

E. S. B.

Maryland State Conference of Social Welfare

The Maryland State Conference of Social Welfare devoted its annual meeting, held on May 19-20, in

The establishment of the JOURNAL OF GERONTOLOGY was made possible by a grant from the Josiah Macy, Jr. Foundation.

The hieroglyphics, "The Beginning of the Book for Transforming an Old Man into a Youth," at the top of this editorial page, are from the Edwin Smith Surgical Papyrus, translated by Professor John Breasted, University of Chicago Press.

Baltimore, to a consideration of "Our Mounting Public Dilemma—Aging and Illness." The two day conference was organized under four sectional meetings: (1) the Economic Aspects of Aging, Income Maintenance and Employment, under the chairmanship of David L. B. Fringer, director of the Maryland State Employment Service, (2) Chronic Illness, Its Prevention, Care and Rehabilitation, under the chairmanship of Harvey H. Weiss, executive director, Sinai Hospital, Baltimore, (3) Educational, Recreational, and Spiritual Needs of the Aged and Chronically Ill, under the chairmanship of Thomas Van Sant, director of Adult Education, Baltimore City Department of Education, and (4) Family Life, Housing and Social Services, under the chairmanship of Milton Goldman, executive director of the Jewish Family and Children's Bureau of Baltimore.

Particular emphasis was placed on home care programs and the concept of self-help among the aged. At the final general meeting of the conference, the reports from the various section meetings were summarized by T. J. S. Waxter, director of the Department of Public Welfare, Baltimore, and a report of current research activities in the problems of aging in chronic illness was made by Dr. Dean W. Roberts, director of the Commission on Chronic Illness. The concluding address was made by Theodore McKeldin, Governor of Maryland.

Age Problem in Employment

The second conference on "The Problem of Making A Living While Growing Old" was held at the William Penn Hotel, Pittsburgh, Pennsylvania, June 4-5, 1953, under the sponsorship of the School of Business and Public Administration, the Bureau of Economic and Business Research of Temple University, the Department of Labor and Industry, and the Bureau of Employment Security of the State of Pennsylvania. The general topic of the conference was Age Barriers to Employment in Pennsylvania. The two-day conference consisted of panel sessions on the following topics: Age and Personal Policies and Practices in Pennsylvania, Age Costs and Employability, Some Social and Economic Aspects of Age Standards in Employee Selection, and Age and the Determination of Physical Fitness for Employment. The final meeting of the conference dealt with specific proposals for solving the age problem in employment.

HISTORICAL SECTION

SIR JOHN FLOYER (1649-1734) was one of the most original physicians of his period. He was the first to make regular observations upon the rate of the pulse and the first to recommend mineral oil for constipation. His "Treatise on Asthma," 1698, gives a postmortem discussion of pulmonary emphysema and assigns as the cause of spasmodic asthma "a contracture of the muscular fibers of the bronchi." His "Medicina Gerocomica: or the Galenic Art of Preserving Old Men's Health," London, 1724, was the first English treatise on the diseases of old age.

F. D. Z.

CONDENSED PROGRAM: Gerontological Society, Inc., Sixth Annual Meeting

Hotel Mark Hopkins—San Francisco—August 25-27, 1953

Tuesday, August 25 8:30-9:30	Registration—Main Lobby			
9:30-12:30	General Session I—Room of the Dons. Chairman: R. V. Lee			
12:30-1:30	Meeting of the Council, Gerontological Society, Inc. (Luncheon)—Phoenix Room			
1:30-4:30	Session A: Scientific Reports: Biology and Medicine Conquistador Room Chairman: A. I. Lansing	Session B: Medical Practice with the Aging Room of the Dons Chairman: E. J. Munter	Session C: Sociology Argonaut Room Chairman: E. Moore	Session D: Symposium I; Recreation Golden Empire Room Chairman: Mrs. B. Low-Beer
8:00-9:30	Motion Pictures on Aging—Room of the Dons. Chairman: Esther Faier			
Wednesday, August 26 9:00-10:30	Symposium II: New Roles for the Aging Room of the Dons Chairman: C. Tibbitts	Symposium III: Gerontologic Implications in Pharmacology Argonaut Room Chairman: O. Guttentag	Symposium IV: Mental Health and Aging Golden Empire Room Chairman: E H. Crawfis	
10:45-12:30	Symposium V: Education for Aging. I. Preparation for Retirement Room of the Dons Chairman: B. Woods	Symposium VI: Biochemical Aspects of Aging Argonaut Room Chairman: S. M. Horvath Co-chairman: A. I. Lansing	Organization of a Western Section of the Gerontological Society Golden Empire Room Chairman: W. J. Kerr	
1:30-4:30	General Session II—Room of the Dons. Chairman: M. Chernin			
4:30-5:30	Business Meeting of the Gerontological Society, Inc.—Room of the Dons. Chairman: E. V. Cowdry			
8:00-9:30	General Session III—Developments in California—Room of the Dons. Chairman: A. J. Falk			
Thursday, August 27 9:00-12:30	Symposium VII: Utilization of Skills of Older Workers Room of the Dons Chairman: G. W. Hobbs	Session E: Scientific Reports: Psychology Argonaut Room Chairman: O. J. Kaplan	Session F: Scientific Reports; Biology and Medicine II Golden Empire Room Chairman: J. A. Hamilton	
1:30-3:00	Spiritual Growth and Maturation Room of the Dons Moderator: Rev. W. J. Flanagan	Symposium VIII: Education for Aging II; Training of Professional Workers Golden Empire Room Chairman: Wilma Donahue		
3:15-5.00	Symposium IX: Housing and Living Arrangements Room of the Dons Chairman: C. I. Schottland	Symposium X: Arteriosclerosis Golden Empire Room Chairman: A. I. Lansing		
6:00	Cocktails—Peacock Court			
7:00	Annual Dinner—Peacock Court			

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ORGANIZATION SECTION

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Program of the Sixth Annual Scientific Meeting of the Gerontological Society, Inc.

August 25-27, 1953

HOTEL MARK HOPKINS
San Francisco, California

Tuesday, August 25

8:30 a.m.-9:30 Registration—Hotel Mark Hopkins, Main Lobby

9:30 a.m.-12:30 p.m. **General Session I**—Room of the Dons
Chairman: R. V. Lee, Palo Alto Clinic, Palo Alto, California

9:30-10:00 BORTZ, E. L.—New Goals for Maturity.

10:00-10:25 LEWIS, W. H.—The Prevention of Heart Disease.

10:30-10:55 GRETHER, E. T.—Aging and the National Economy.

11:00-11:25 BOWMAN, K. M.—Personality Development in Aged Adults.

11:30-11:55 MORGAN, AGNES F.—Nutritional Aspects in the Aging.

12:00-12:25 HITT, H. L.—Migration Trends Among Older People.

(The 5 minute interval between scheduled presentations is reserved for discussion)

12:30 p.m. Luncheon Meeting, Council of the Gerontological Society, Inc.—Phoenix Room

Tuesday Afternoon, August 25

1:30-4:30 p.m. **Session A: Scientific Reports; Biology and Medicine**—Conquistador Room

Chairman: A. I. Lansing, Washington University, St. Louis, Missouri

1:30-1:45 THOMAE, JR., F. W., and ROSENE, HILDA F.—Respiration and Starvation in Relation to Aging in Root Tissue.

1:50-2:05 BENTLEY, A. J., and SODERWALL, A. L.—Observations on Germ Cell Viability and Fertility in the Female Hamster Reproductive Tract.

2:10-2:25 ANDREW, W.—Phenomena of Abnormal Nuclear Division in Relation to the Aging Process.

2:30-2:45 BROWNSON, R. H.—The Effects of Fatigue on the Anterior Horns of the Mouse Spinal Cord, C_5–Th_1 Level, Relative to Aging Processes.

Cocktails—Peacock Court
Annual Dinner—Peacock Court
6:00
7:00

2:50-3:05 BIRREN, J. E., and WALL, P. D.—Age Changes in Functional and Structural Characteristics of Peripheral Nerves in Rats.

3:10-3:25 RUNNER, M. N.—Skeletal Anomalies in the Mouse as Influenced by Parental Age.

3:30-3:45 COWDRY, E. V., and SUNTZEFF, V.—Maternal Age and Leukemia in Offspring.

3:50-4:05 COBB, W. M.—Suture Closure as an Index of Age.

4:10-4:25 BAIRD, B., and BAIRD, CATHERINE—Isolated and Artificial Organs: Applications in Gerontology and Geriatrics.

(The 5 minute interval between scheduled papers is reserved for discussion)

1:30-4:30 p.m. **Session B: Medical Practice with the Aging**—Room of the Dons

Chairman: E. J. Munter, University of California, School of Medicine, San Francisco, California

1:30-1:45 HINMAN, F.—The Problem of the Prostate.

1:50-2:05 GRIFFITH, G. C.—Anticoagulants and the Prevention of Vascular Accidents.

2:10-2:25 GOODRICH, B. E., and SCHUMACHER, E. E., JR.—Lung Compensation and Failure.

2:30-2:45 ROEN, P. B.—Medical Management of Nocturia.

2:50-3:05 ACKERMANN, P. F., TORO, G., KOUNTZ, W. B., and KHEIM, T.—Influence of Hormones on Calcium and Nitrogen Balance in Elderly Female Subjects.

3:10-3:25 WAYNE, G. J.—Occupational Therapy in the Aging.

3:30-3:45 COMMONS, R. R.—Complications of Steroid Therapy.

3:50-4:05 HARRIS, R., and PHELAN, J. J.—The Treatment of Hypertension in the Elderly Patient with 1-hydrazinophthalazine.

4:10-4:25 MORRISON, L. M.—Results of Low Cholesterol-Low Fat Diet Plus Lipotropes in the Treatment of Atherosclerosis.

(The 5 minute interval between scheduled papers is reserved for discussion)

1:30-4:30 p.m. **Session C: Sociology**—Argonaut Room

Chairman: E. Moore, Portland State College, Portland, Oregon

FANSHEL, D., KUTNER, B., and LANGER, T.—Aging: A Cross-Sectional Survey and Action Program.

BURGESS, E. W., HOYT, G. C., and MANLEY, C.—The Construction of Scales for the Measurement of Motivation in Internal Migration after Retirement.

KEYS, W. E.—Proposal for a Gerontology Building at a World's Fair.

McKAIN, JR., W. C.—Potentials of an Aging Population: The Connecticut Approach.

LUND, H. H.—A Statewide Survey: Situation and Needs of the Aging.

BUNZEL, J. H., and GARE, L.—Factors in Satisfaction with Retirement.

DISCUSSION

1:30-4:30 p.m. **Session D: Symposium I; Recreation: Its Place and Function in Community Organization**—Golden Empire Room

Chairman: Mrs. B. V. Low-Beer, Community Committee on the Aged, Community Chest of San Francisco, San Francisco, California

Development of Recreation Services for Older People, in Different Settings and Under Different Auspices.

MYERS, ANNA S. (Mrs.)—The Place of an Old Age Home in the Community.

KAPLAN, J.—A Public Welfare Agency Experience in Meeting Some of the Needs of Older People Through a Community Recreation Program.

BARTLETT, L. W.—The YMCA Pilots a Program for Older Adults.

Panel Discussion: Personal Problems of Older People as Revealed in Senior Recreation Centers and the Role of the Caseworker in a Recreation Center Program.

Participants:

Mathilde Fingelstein, Caseworker, Jewish Family Service Agency, San Francisco, California

Dorothy Green, Counselor, Montefiore Center, San Francisco, California

Mrs. Augusta Ury, Former Counselor, Montefiore Center, San Francisco, California

Emily Wooley, Consultant, San Francisco Senior Center, San Francisco, California

Tuesday Evening, August 25

8:00-9:30 p.m. **Motion Pictures on Aging** (Arranged by the San Francisco Regional Office, U. S. Department of Health, Education, and Welfare)—Room of the Dons

Chairman: Esther Faier, San Francisco Regional Office, San Francisco, California.

Commentator: H. Schumacher, Regional Mental Health Consultant, Public Health Service, San Francisco, California.

Retire to Life—International Film Bureau, 57 East Jackson Boulevard, Chicago 4, Illinois.

Seventh Age—Danish Information Service, 588 Fifth Avenue, New York 36, New York.

The Montefiore Home—The Montefiore Home, Cleveland Heights, Ohio.

Your Social Security—Local Social Security Administration Field Offices, Department of Health, Education, and Welfare.

Wednesday Morning, August 26

9:00-10:30 a.m. **Symposium II: New Roles for the Aging**—Room of the Dons

Chairman: C. Tibbitts, Committee on Aging & Geriatrics, U. S. Department of Health, Education, and Welfare, Washington, D. C.

Keynote Address: New Roles for the Aging. L. Kuplan, Executive Secretary, Inter-Department Coordinating Committee on the Problems of the Aging, State of California, Sacramento, California.

Panel:
Mrs. C. Zollinger, Portland, Oregon.
Florence Vickery, San Francisco, California.
W. Hepner, San Diego, California.
Virginia M. Scheier, Menlo Park, California.

9:00-10:30 a.m. **Symposium III: Gerontologic Implications in Pharmacology** — Argonaut Room

Chairman: O. Guttentag, University of California Medical School, San Francisco, California

Sensitivity to Drugs at Various Age Levels; Lower Organisms. H. Johnstone, Department of Parasitology, University of California, Berkeley, California.

Sensitivity to Drugs at Various Age Levels; Higher Organisms. S. A. Peoples, Department of Pharmacology, University of California, School of Veterinary Medicine, Davis, California.

Toxicity Levels in Man with Relation to Age. C. Hine, Department of Toxicology, University of California, Berkeley, California.

Reaction Levels to Biophysical Agents with Relation to Different Ages. H. B. Jones, Donner Laboratory, University of California, Berkeley, California.

Reaction Levels to Shock Treatment and Other Physical Procedures in Psychiatry with Relation to Age. L. H. Margolis, Department of Psychiatry, University of California, Berkeley, California.

9:00-10:30 a.m. **Symposium IV: Mental Health and Aging**—Golden Empire Room

Chairman: E. H. Crawfis, Deputy Director for Medical Services, California Department of Mental Hygiene, Sacramento, California

Discussion of a Study of the Somatic and Psychologic Factors Leading to the State Hospital Admission of Patients with Conditions Diagnosed as Senile Psychosis or Psychosis with Cerebral Arteriosclerosis.

Panel:
W. A. Oliver, Clinical Director, Napa State Hospital, Imola, California

A. Simon, Assistant Superintendent, Langley Porter Clinic, San Francisco, California

N. Malamud, Neuro-Pathologist, Langley Porter Clinic, San Francisco, California

J. W. Gofman, University of California, Berkeley, California

10:45-12:30 a.m. **Symposium V: Education for Aging. I. Preparation for Retirement.** (Arranged jointly with the Adult Education Association, USA)—Room of the Dons

Chairman: B. Woods, Vice President, University of California, Berkeley, California

JOHNSON, G. E.—A Program to Prepare College Teachers for Retirement.
HALL, H. R.—Activity Planning for Retirement by Executives.
MOORE, E. H.—The Personnel Officer in Retirement Preparation.
SALAMONE, A.—The St. Louis Program.
BARRON, ANN M.—The Gerontology Program in the Los Angeles Adult Schools.

DISCUSSION

10:45-12:30 **Symposium VI: Biochemical Aspects of Aging**—Argonaut Room

Chairman: S. M. Horvath, University of Iowa, Iowa City, Iowa
Co-Chairman: A. I. Lansing, Washington University School of Medicine, St. Louis, Missouri

Panel:

M. Kleiber, University of California, State Agriculture College, Davis, California

P. C. Aebersold, Chief, Isotope Division, Atomic Energy Commission, Oak Ridge, Tennessee

M. Friedman, Cardiovascular Laboratory, Mount Zion Hospital, San Francisco, California

10:45-12:30 **Organization of a Western Section of the Gerontological Society**—Golden Empire Room

Chairman: W. J. Kerr, University of California Medical School, San Francisco, California

12:30-1:30 Sectional Luncheons as Scheduled

Wednesday Afternoon, August 26

1:30-4:30 p.m. **General Session II**—Room of the Dons

Chairman: M. Chernin, School of Social Welfare, University of California, Berkeley, California

1:30-1:55 BERWICK, G. C.—Forecasting the Aging Population.

2:00-2:25 McFARLAND, R. A.—Problems of Aging in Air Transportation.

2:30-2:55 LANSING, A. I.—Age Changes in Body Cells.

3:00-3:25 SHERWOOD, K. K., and BENNETT, E. S.—Successful Administrative Techniques in a Geriatric Unit Associated with a General Hospital.

3:30-3:55	SIMON, A., and MALAMUD, N.—Inadequacy of Clinical Diagnosis in Psychoses Associated with Old Age.
4:00-4:25	BRESLOW, L.—Aging and Community Health Programs.
	(The 5 minute interval between scheduled papers is reserved for discussion)
4:30-5:30 p.m.	**Business Meeting of Gerontological Society, Inc.**—Room of the Dons
	Chairman: E. V. Cowdry, Washington University, St. Louis, Missouri

Wednesday Evening, August 26

8:00-9:30 p.m.	**General Session III: Developments in California Since the Governor's Conference on the Problems of the Aging, October, 1951**—Room of the Dons
	Chairman: A. J. Falk, Chairman, Governor's Conference on Problems of Aging, Sacramento, California
Speakers:	L. Kuplan, Executive Secretary, Governor's Interdepartmental Coordinating Committee on Aging, Sacramento, California
	L. Breslow, Chief, Bureau of Chronic Disease, State Department of Public Health, San Francisco, California
	Mrs. G. D. Cohn, President of the Board of Directors, San Francisco Senior Center, San Francisco, California
	Mrs. W. N. Whittmore, American Women's Voluntary Services, Santa Barbara, California
	M. J. Ostomel, Assistant Secretary, Welfare Council of Metropolitan Los Angeles, Los Angeles, California

Thursday Morning, August 27

9:00-12:30 a.m.	**Symposium VII: Utilization of the Skills of Older Workers**—Room of the Dons
9:00-10:00	*Chairman:* G. W. Hobbs, National City Bank of New York, New York, New York
	ALLER, C. C.—Report of Certain Aspects of the University of California Study of "An Aging Population in an Industrial Society."
	BERS, M.—Union Policy and the Older Worker.
	STEINER, P.—Receipts Status of the Aged; 1951.
10:15-11:15	Contributions to the Utilization of Skills of Older Workers.
	Chairman: F. G. Sladen, Detroit, Michigan
Management:	D. Sargent, Personnel Director, Consolidated Edison Company, New York, New York
Labor:	P. Schrade, President, Local 887, UAW-CIO, Los Angeles, California
Industrial Medicine:	Dr. C. Leggo, California Hawaiian Sugar Refining Corp., Ltd., San Francisco, California
Placement & Counseling:	B. Hanman, Berkeley, California

11:30-12:30	Panel Discussions
	Chairman: G. W. Hobbs, National City Bank of New York, New York, New York
	Inter-panel Discussion
	Panel-audience Discussion
9:00-12:30 p. m.	**Session E: Scientific Reports; Psychology**—Argonaut Room
	Chairman: O. Kaplan, San Diego State College, San Diego, California
9:00-9:15	BRITTON, J. H., and SMITH, W. M., JR.—Relationships Within Three-Generation Families.
9:20-9:35	BAYLEY, NANCY—The Maintenance of Intellectual Ability in Gifted Adults.
9:40-9:55	OWENS, W. A.—Age and Mental Abilities; A Longitudinal Study.
10:00-10:15	FRENKEL-BRUNSWIK, ELSE—Social and Psychologic Problems in Old Age.
10:20-10:35	LOEB, M. B.—Middle-Age and Aging in the Community.
10:40-10:55	HANDLON, B. J.—Attitudes Toward Old People.
	(The 5 minute interval between scheduled papers is reserved for discussion)
9:00 a.m.-12:15 p.m.	**Session F: Scientific Reports; Biology and Medicine II**—Golden Empire Room
	Chairman: J. A. Hamilton, Stanford University School of Medicine, San Francisco, California
9:00-9:15	PARFENTJEV, I. A.—Susceptibility to Infection During the Life Span.
9:20-9:35	ROGERS, J. B.—Induction of Tumors in Senile Guinea Pigs.
9:40-9:55	McVAY, L. V., and SPRUNT, D. H.—Long Range Study of the Use of Broad Spectrum Antibiotic in Elderly People.
10:00-10:15	GRAD, B., and CAPLAN, L.—Changes in Oxygen Consumption and Heart Rate During Growth and Aging in Rats: Role of the Thyroid Gland.
10:20-10:35	SHOCK, N. W., YIENGST, M. J., and WATKIN, D. M.—Age Changes in Body Water and Its Relationship to Basal Oxygen Consumption in Males.
10:40-10:55	LEV., M.—Aging Changes in the Human Sinoatrial Node.
11:00-11:15	WOERNER, C. A.—Exogenous Lipids and Mycopolysaccharides as Factors in Experimental Arteriosclerosis.
11:20-11:35	ENGELBERG, H.—Plasma Heparin Levels; Relation to Serum Lipids, Lipoproteins, and Atherosclerotic Disease.
11:40-11:45	CROMWELL, L. W.—Heberden's Nodules and Calcium Deficiency.
11:50-12:05	PERLMAN, R. M.—Combined Steroid and Nutritional Therapy in Geriatric Rehabilitation.
	(The 5 minute interval between scheduled papers is reserved for discussion)

Thursday Afternoon, August 27

1:30-3:00 p.m. **Spiritual Growth and Maturation**—Room of the Dons

Moderator: Right Rev. Monsignor W. J. Flanagan, General Director, San Francisco Catholic Social Service, San Francisco, California

Panel:

Rabbi S. Akselrad, Temple Beth El, Berkeley, California

Rev. J. T. McCracken, Assistant Director, Catholic Social Service, Oakland, California

Very Rev. Canon K. E. Nelson, Executive Secretary, Department of Social Relations, Episcopal Diocese of California, San Francisco, California

1:30-3:00 p.m. **Symposium VIII: Education for Aging. II. Training of Professional Workers** (Arranged in Cooperation with the Adult Education Association, USA)—Golden Empire Room

Chairman: Wilma Donahue, Division of Gerontology, University of Michigan, Ann Arbor, Michigan

Panel:

E. W. Burgess, Institute of Industrial Relations, University of Chicago, Chicago, Illinois

Sister John of the Cross, Providence Hospital, Seattle, Washington

N. W. Shock, Section on Gerontology, National Institutes of Health, Public Health Service, and Baltimore City Hospitals, Baltimore, Maryland

G. Hurff, Director, Bureau of Business & Economic Research, University of Florida, Gainesville, Florida

W. H. Reals, Dean, University College, Washington University, St. Louis, Missouri

3:15-5:00 p.m. **Symposium IX: Housing and Living Arrangements**—Room of the Dons

Chairman: C. I. Schottland, California Coordinating Committee, on Problems of the Aging, Sacramento, California

WALL, B. R.—Policies of Admission and Finance in Homes for the Aged.

WEIL, J.—Special Services for the Senile in a Home for the Aged.

WAGNER, A.—Physical Profile of an Aged Group: Data on the First One Hundred Admissions to a New Home for Elderly Women.

OSTOMEL, M. J.—Non-Institutional Living Arrangements.

FRAENKEL, MARTA—Relation of Home Care to Living Arrangements.

BOWDISH, P. R.—Place of the Nursing Home in the Care of the Aged Sick.

DISCUSSION

3:15-5:00 p.m. **Symposium X: Arteriosclerosis**—Golden Empire Room

Chairman: A. I. Lansing, Department of Anatomy, Washington University School of Medicine, St. Louis, Missouri

Panel:

J. F. Rinehart, Department of Pathology, University of California School of Medicine, Berkeley, California

C. A. Woerner, Department of Anatomy, University of Louisville, Louisville, Kentucky

S. M. Evans, Department of Anatomy, Marquette University School of Medicine, Milwaukee, Wisconsin

H. S. Simms, Department of Pathology, College of Physicians and Surgeons, New York, New York

J. E. Kirk, Division of Gerontology, Washington University School of Medicine, St. Louis, Missouri

6:00 p.m. Cocktails—Peacock Court

7:00 p.m. Annual Dinner—Peacock Court

Presidential Address—E. V. Cowdry, Washington University School of Medicine, St. Louis, Missouri

Speaker: J. H. Sheldon, President, Third International Gerontological Congress, Royal Hospital, Wolverhampton, England

Other speakers will be announced

Friday, August 28

Meeting of the Committee on the Aging of the National Social Welfare Assembly, Inc.

All sessions will be held at the Hotel Mark Hopkins

(See Abstracts, Page 385.)

Gerontological Society, Inc. Committee Members for 1953

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Dr. W. B. Kountz
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San Diego State College
San Diego, California

Social Work:

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* Due to the death of Dr. Raymond Hussey, final arrangements for the program on clinical medicine were generously completed by Dr. Freeman and Dr. Kountz.

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Dr. Henry S. Simms
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Miss Georgia F. McCoy
New York University—Bellevue Medical Center
301 East 38 Street
New York, New York

Mr. William Posner
Assistant Director, Jewish Community Services of Queens-Nassau
New York, New York

Abstracts of Scientific Papers

(*Abstract not received at time the program went to press.)

A

Influence of Hormones on Calcium and Nitrogen Balance in Elderly Female Subjects.

P. G. ACKERMANN, G. TORO, W. B. KOUNTZ, *and* T. KHEIM, *Division of Gerontology, Washington University School of Medicine, St. Louis, Missouri.*

The effect of hormones on the nitrogen and calcium balance was studied in 8 post-menopausal elderly female subjects. Some of the subjects were given estradiol for several months and menstruation then induced either by the cyclic withdrawal of the estradiol or the administration of progesterone for three successive days each month. The nitrogen and calcium balances were studied before and during the administration of the hormones. No significant changes were observed in either balance. Subjects were then given larger dosages of progesterone or testosterone in addition to the estradiol. These dosages, particularly of the testosterone, caused an increase in nitrogen retention. The calcium balance also showed a tendency to increase but the change was not significant. The calcium requirement prior to the administration of the hormones in the elderly females was less than previously found for elderly males.

Report of Certain Aspects of the University of California Study of "An Aging Population in an Industrial Society."*

C. C. ALLER, *Institute of Industrial Relations, University of California, Berkeley, California.*

Phenomena of Abnormal Nuclear Division in Relation to the Aging Process.

W. ANDREW, *Department of Anatomy, Bowman Gray School of Medicine, Winston-Salem, North Carolina.*

Mitotic activity in the salivary glands is a conspicuous phenomenon during the period of growth of the organ. When the process begins to slow down, the mitotic figures frequently present abnormal patterns. Densely pycnotic nuclei in the salivary gland of 100 day old rats seem to represent prophases, while even metaphases and anaphases present an appearance of irregular clumping of the chromatin material in many cells, without distinguishable chromosomes. Such cells probably die during the process of irregular mitosis. In mature animals, 200 to 600 days old, the glands show practically no evidence of nuclear division of any type. In senile animals, those 700 days and over, another type of abnormal division is seen, namely amitosis, or nuclear division without chromosome formation. Criteria of this type of division are discussed, particularly the importance of division of the nucleolus. Conditions in the salivary glands through the life history of the rat are compared with those existing in the nervous system and in the liver and other organs.

B

Isolated and Artificial Organs: Applications in Gerontology and Geriatrics.

B. BAIRD *and* CATHERINE BAIRD, *Division of Physiology and the Division of Anatomy and Institute of Experimental Biology, University of California, Berkeley, California.*

Historically important experiments with isolated and artificial organs are reviewed. Contributions which have received less attention than they merit are described briefly.

A body of useful data based on numerous experiments with isolated hearts, lungs, kidneys, blood vessels, and other organs is accumulating in the laboratories of contemporary investigators. Summarization and evaluation of some of these contributions is essayed.

Physiologic principles demonstrable by the use of isolated and artificial organs are stressed; methodology and technologic complexity are minimized for purposes of clarity.

The framework of reference for this paper is the proper application of the physiologic principles, methods, and apparatus discussed to gerontologic research and geriatric practice.

The Gerontology Program in the Los Angeles Adult Schools.

ANN M. BARRON, *Consultant in Gerontology, Los Angeles, California.*

Los Angeles has approximately 175,000 adults in the "60 plus" group, so we decided to try an experimental program during the Summer of 1951. The older students enthusiastically enrolled in the classes and encouraged us with an attendance of 1600 student hours in four adult schools. Programs have been offered in 22 schools over a period of three years.

The Gerontology Program became the name of the course and consisted of Geriatrics, Mental Hygiene, Nutrition, Economics, and Leisure Time Arts and Crafts. The objectives of the program were: (1) to establish broadened interests in order to relieve the monotony of retirement; (2) to aid older adults in adjusting to the physiologic, psychologic, emotional, and mental changes which accompany aging after 60; (3) to make living in the later years more purposeful; (4) to study community resources for economic and

social opportunities; and (5) to present recent findings on health, psychology, and nutrition from research and other sources.

We have learned many facts about the older adult during the past three years and are convinced that the older adults are not being served in Adult Education; that instructors are not trained to lead successfully the more experienced older adult; that favorable housing is not accessible for this older, less agile group; and that they are definite about their educational needs and quite determined to seek out schools where they will find the seasoned leadership they require for a happier, more comfortable, and more satisfying later maturity.

The Y.M.C.A. Pilots a Program for Older Adults. L. W. BARTLETT, *Older Adult Program, Hyde Park Y.M.C.A., Chicago, Illinois.*

Three years ago the Hyde Park Y.M.C.A. in Chicago initiated a project to extend its services to persons in their later years. Money to underwrite this project until it could get on its feet was made available by the Chicago Y.M.C.A. Within the three years an organization known as the Hyde Park Seniors, with a council and regular committees was achieved, a varied program of activities was developed, and a substantial and loyal membership secured. Included in its achievements the Hyde Park Seniors now has several active interest groups: a weekly round table, music group, folk and square dancing group, craft group, and an art appreciation group. Special events include: an institute of six sessions, talent night, annual bazaar, parties, and a guest luncheon for persons 80 years of age and over.

Objectives that at first were defined but not too deeply felt have become fundamental in the affairs of the organization. Among them are: (a) the later years, like childhood and adolescence, etc. is a period of life with its own unique challenges and responsibilities; (b) the organization and program are, as far as possible, of seniors, by seniors, and for seniors; (c) the abilities and interests of seniors are exercised and expressed in various ways to keep them from "retiring."

Through membership dues, fees from special events, and contributions from seniors, the Hyde Park Seniors has demonstrated an ability to "stand on its own feet" except for gratis use of facilities by the Y.M.C.A. This has developed a pride in their organization and a deep feeling of personal worth.

The Maintenance of Intellectual Ability in Gifted Adults.

NANCY BAYLEY, *University of California, and* MELITA H. ODEN, *Stanford University, Berkeley, California.*

Although numerous studies now show a tendency for adults to exhibit decreasing intellectual abilities (as measured in test scores) with age, there is, as yet, little evidence concerning the stability or change in such scores of the same individuals. In this report we are comparing the scores earned approximately twelve years apart on a test designed to measure superior intelligence (the Concept Mastery), by members of Terman's Gifted Study.

Almost 800 "Gifteds" took both form A of the Concept Mastery test in 1930-1940 and form B in 1951-1952. Their average age at the earlier testing was 29.5 years, with a standard deviation of 3.7 years: at the later testing they averaged 42 years. When originally selected in 1922 their IQ's were all 135 or higher, averaging about 3 sigma above the general population. In the 1940 testing it was estimated that their Concept Mastery scores put them 2 sigma above the general population. The two forms of the Concept Mastery have been equated on independent samples of college students and other adults. In addition, about 425 spouses took the tests both in 1939-1940 and 1951-1952, earning scores similar to those of the college populations.

Changes in scores between the two testings are compared on the basis of scores on the first test, sex, age groups, educational level, occupational rating, and estimates of general success.

Observations on Germ Cell Viability and Fertility in the Female Hamster Reproductive Tract. A. J. BENTLEY *and* A. L. SODERWALL, *Department of Biology, University of Oregon, Eugene, Oregon.*

Using the bases of the heat cycles and predicted ovulation times in the female golden hamster, artificial inseminations were made into such animals at varying times prior to and subsequent to ovulations.

The sperm suspensions were obtained from the epididymis and/or the vas deferens. The resulting impregnations favored the latter source. The estimated quantity of sperm for the inseminations was around 50,000,000, divided between the two horns of the uterus. A blunt pointed hypodermic needle and syringe withdrew the prepared sperm suspension and introduced the material directly into the respective uterine horns.

Following insemination, a vaginal plug was insured either by allowing copulation with a vasectomized male or by an artificial vaginal plug prepared by dipping a small cotton pledget into the fluids of the seminal vesicles and coagulating gland.

Subsequent observations determined the relative length of functional survival of the spermatozoa or the ova in effecting fertilization and pregnancy, the relative litter size at time of parturition, and the normality of the young delivered.

The maximum duration of the fertilizing capacity for sperm artifically inseminated was seven hours, with a precipitous decline in number of successful impregnations after five hours. Similar inseminations

following ovulation indicate that the ova are short lived in their fertilizability, a matter of a few hours.

In no instance of all the pregnancies studied was there any indication of abnormalities of birth or offspring. The possibility of resorption in utero has not been discounted.

Union Policy and the Older Worker.

M. Bers, *Institute of Industrial Relations, University of California, Berkeley, California.*

This paper, based primarily on study of a dozen major unions operating in the San Francisco Bay area, focuses attention on union policies concerning a number of critical issues—hiring, seniority, compulsory retirement, pensions, etc.—relating to the erection or elimination of barriers to the employment of older workers. An attempt is made to identify the important influences contributing to the considerable variation in policies noted. Subject to certain qualifications, appraisals of the impact of union policy in various labor markets are offered.

Forecasting the Aging Population.*

G. C. Berwick, *Associate Medical Director, Metropolitan Life Insurance Co., San Francisco, California.*

Age Changes in Functional and Structural Characteristics of the Peripheral Nerve in Rats.

J. E. Birren *and* P. D. Wall, *The National Institute of Mental Health and The Department of Anatomy of the University of Chicago, Chicago, Illinois.*

Conduction velocity and refractory period measurements were made on the sciatic nerve of over 75 albino Norwegian rats, age 60 to 850 days. Nerves were excised and placed in mineral oil at 37 C. and stimulated by a supra maximal square wave potential lasting 0.18 msec. Action potential velocities were computed from oscillograph records of the time required to pass 20 mm. between pickup electrodes.

Conduction velocity increased during development but did not change significantly after maturity. Modal velocity increased from about 27 M. per second at 60 days to 53 M/sec at 350 days and 54 M/sec at 650 days (median values). Maximum velocities, inflection, were about 31 M/sec at 60 days, 59 M/sec at 350 days, and 60 M/sec at 650 days. Standard error of measurement of modal velocity was about 1.5 M/sec, and about 2.9 M/sec for maximum velocity. The absolute refractory period was about 0.75 msec. at 60 days, 0.54 msec. at 350 days, and 0.52 msec. at 650 days. Fifty per cent recovery occurred at about 1.30 msec. at 60 days, 0.82 msec. at 350 days, and 0.81 msec. at 650 days.

Comparisons of nerves fixed in osmic acid and by freezing-drying showed that swelling of myelin in osmic acid results in a large ratio of outside diameter to axon diameter and a lower estimate of interfiber spacing, i.e., connective tissue. Frozen-dried sections showed 40 per cent connective tissue, osmic acid 18 per cent. Total fiber counts and fiber diameters show large regional differences. Whole nerve shows a flat, unimodal distribution with a median at 4.5 μ and a maximum fiber diameter of 15 μ (frozen-dried section).

New Goals for Maturity.

E. L. Bortz, *Philadelphia, Pennsylvania.*

Studies of aging encompass the growth and development of the individual throughout the life span. Various tissues within the body follow varying time cycles of maturation.

Gerontology directs attention to evolving processes of human development in the middle and later periods of life.

The concept of values for the individual and society adds significance to the interpretation of growth and development.

Maturity suggests fulfillment in terms of enduring satisfactions for the individual and greater stability for the social order. Goals for maturity should be defined, if possible, in terms of potentials. Gerontology should explore in greater detail the capabilities and aspirations of individuals whose lives are being lengthened through the increasing efficiency of the scientific method.

The study of aging processes is one of the major problems of modern science.

The Place of the Modern Nursing Home in the Care of the Aged Sick.

P. R. Bowdish, *Medical Director, St. Louis Infirmary, St. Louis, Missouri.*

The American Association of Licensed Nursing Homes is an organization committed to 1) raising the level of nursing homes both in administrative operation and equipment to the level of well-run chronic hospitals, 2) influencing legislation which would grant financial assistance to patients who are not entirely able to pay for this type of service, and 3) bringing nursing homes operating in this type of program under adequate State supervision.

The Association is composed of nursing home operators who are interested in raising nursing home operation from its present level of a business institution to the standards of acceptable hospital grade. Achievement of this goal will require not only extensive changes in equipment but marked improvement in the qualifications of nursing personnel as well as adequate supervision of dietetic medical care. It is hoped that through systematic effort, nursing homes in America may reach or exceed the qualifications of those now operating on a high level in Great Britain.

Personality Developments in Aging Adults.

K. M. Bowman, *Langley Porter Clinic, San Francisco, California.*

Personality is continuously changing from the time of birth until the time of death. The changes that occur depend upon heredity, which determines one's potentialities, and environment (physical, mental, cultural) which brings out or represses these potentialities. While there are certain standard patterns of personality development for aging adults, there are enormous individual differences based on differences of heredity and environment. These resemblances and differences are discussed with some suggestions for better mental health in older persons.

Aging and Community Health Programs.

L. Breslow, *Chief, Bureau of Chronic Diseases, California Department of Public Health, Berkeley, California.*

Aging of the population demands a reorientation of community health services.

Health department activities, such as education, statistics, nursing, and case-finding, increasingly reflect the changing pattern of disease in this country. Voluntary health effort, once devoted almost exclusively to problems of early life, now raises public interest and funds for the control of cancer, heart disease, and other major disease problems of an older population. Community planning for hospitals and housing—in fact for all facilities with health implications—take into account the age-trend and its portent for illness.

But fundamentally in our approach to this problem, we must strive to develop means of health maintenance into the later years of life. Only in this way can we hope to make progress against this growing social and health problem. Some suggestions will be made on how this may be accomplished.

Relationships Within Three-Generation Families.

J. H. Britton *and* W. M. Smith, Jr., *Department of Child Development and Family Relationships, The Pennsylvania State College, State College, Pennsylvania.*

This investigation, one of a series of studies by the Committee for Study of Adulthood, seeks to provide information concerning living arrangements and relationships within families where three generations live together. The study population includes all three-generation families in two non-metropolitan communities, one having a population of 10,000, the other approximately 1,000. A member of each generation was asked questions concerning physical, financial, and personal arrangements involved for the three generations to live together; in addition, participants were asked about the satisfactions and dissatisfactions of such living arrangements.

Data are presented which show the attitudes and opinions of the participants toward living together as a three-generation family, and these data are related to the adjustment of the first generation member, his health, his work, and his feelings about family.

The Effects of Fatigue on the Anterior Horns of the Mouse Spinal Cord, C_5—Th_1 Level, Relative to Aging Processes.

R. H. Brownson, *Department of Physiology, George Washington University School of Medicine, Washington, D. C. Present address: Department of Anatomy, University of Southern California School of Medicine, Los Angeles, California.*

This investigation was developed in an effort to establish a better understanding of some of the qualitative and quantitative changes that occur in the central nervous system as a result of age and/or fatigue.

The question as to whether or not intense functional activity is accompanied by demonstrable histologic alterations is still an unsettled question. It is now generally accepted that certain progressive, measurable changes do occur in the central nervous system as a result of aging processes, and that these changes may be the net result of the tissue's inability to maintain homeostasis in a changing environment.

For this study, pedigreed female mice at various age levels were subjected to rotary cage fatigue until exhausted. Control animals of the same age, sex, and strain were used. The only environmental variant was forced fatigue in the experimental group. The control mice were sacrificed simultaneously with the experimental animals by means of the perfusion-fixation technique. Immediately following the experience of acute fatigue, age and weight, before and after forced exercise, cage speed and fatiguing time were recorded for the experimental group. The age and weight of the control animals were also recorded.

Nerve tissues from both control and experimental animals were then prepared simultaneously in the usual histologic manner. Nuclei in the anterior horn cells from the spinal cord, C_5—Th_1 level, from both groups at various age levels were measured. Various ratios of the cellular and extra-cellular structures in the anterior horns of the spinal cord were established by means of Chalkley's method. Glial satellite cell counts were made by use of a micrometer disc method. Qualitative determinations were carried out in the anterior horn cells by means of their thionin staining capacities, and also by the Golgi apparatus reduced silver reactions in both control and experimental animals of all age groups.

A statistical analysis was performed on the quantitative experimental data with a view of justifying acceptance or rejection of two hypotheses. First, that certain morphologic alterations of the cytoplasm and nucleus in the anterior horn nerve cells of the spinal cord may occur as the result of the fatigue. Secondly, that significant extra-cellular alterations in the

parenchyma of the anterior horns also occur as the result of fatigue. Both hypotheses were observed with particular reference to the factor of age.

From an analysis of the anterior horn cell components, and the extra-cellular structures of the anterior horn, the author feels justified in concluding that the processes of aging and/or fatigue are responsible for producing certain significant alterations in the anterior horns of the spinal cord of the mouse at the C_8—Th_1 level.

(This present article is based on a part of a dissertation presented to the Faculty of the Graduate Council of The George Washington University in partial fulfillment of the requirements for the degree of Doctor of Philosophy, 1953. Thesis directed by Dr. Chester E. Leese, Professor of Physiology and Dr. Warren Andrew, Professor of Anatomy.)

Factors in Satisfaction with Retirement.

J. H. BUNZEL *and* L. GARE, *Mayor's Advisory Committee for the Aged, New York, New York.*

Within the framework of a broad exploratory research program, the Mayor's Advisory Committee for the Aged of New York City has made a questionnaire study of retired teachers of New York City and retirees of the New York City Employees Retirement System. A 4-page questionnaire was mailed to a random sample from each of these groups: nearly 1500 usable returns were obtained.

The study presents a factual description of the present situation affecting more than 25,000 pensioners in New York City. Basic social data thus obtained can be contrasted wherever applicable with the findings from a record study of a 1 per cent sample of Old Age Assistance recipients of the New York City Department of Welfare.

An attempt has been made to study the relationship between anticipation of retirement and satisfaction or dissatisfaction with retirement afterwards. These changes between anticipation and fulfillment were studied in the light of their relationship to other changes in the retired individual's situation. An analysis of the relationship between satisfaction with retirement and income received in retirement revealed the obvious that the higher income was positively related to greater satisfaction to retirement.

It was found that inadequate income of itself does not necessarily constitute the main cause for dissatisfaction with retirement. In fact increased income may release time and energy to turn the attention of the retiree to other problems.

Later analyses show ambivalence toward retirement and point up the two basic needs for adequate income and satisfactory use of leisure time. Therefore cross correlations with the number and quality of activities have been analyzed; the findings suggest that satisfaction with retirement is on every income level positively related to social participation. Finally, pre-retirement and post-retirement attitudes were analyzed; the findings suggest that some anticipations were borne out by actual retirement experience while others changed positively or negatively.

It must be pointed out that further and most intensive research as well as open-ended community interviews will be necessary in order to assess reliably the value of the responses given. It will be necessary to specify the various dimensions of the retirement problem as well as the factors contributing to satisfaction or dissatisfaction with retirement. Intensive longitudinal interviews may be the means for the achievement of this goal.

The Construction of Scales for the Measurement of Motivation in Internal Migration after Retirement.

E. W. BURGESS, G. C. HOYT, *and* C. MANLEY, *Industrial Relations Center, University of Chicago, Chicago, Illinois.*

Persons 65 years and over are the most sedentary age group in the population of the United States. After retirement they tend to remain in the home community, often continuing to reside in the same house. Yet they now have more freedom to move to a location of their choice without the necessity of considering conditions of employment.

Scales have been constructed and are being tested out in Chicago and in Florida to measure the different motivations—health, economic, relatives, friends, activities, status, previous mobility—that impel retired persons either to remain in the residence of their middle years or to move to a different location. Special attention is given to migration to Florida.

C

Suture Closure as an Index of Age.

W. M. COBB, *Department of Anatomy, Howard University, Washington, D. C.*

The degree of closure of cranial and facial sutures was recorded for 2351 adult skulls of white and Negro stocks in the documented skeletal collections assembled by Todd at Western Reserve and Terry at Washington University. The data show closure to be an age change of great individual variability, hence assessment of age in a given skull must be based on a knowledge of the trends in closure for each suture. Diagrams, graphs, and tables illustrate the findings.

Complications of Steroid Therapy.

R. R. COMMONS, *Department of Medicine, University of Southern California School of Medicine, Los Angeles, California.*

Metabolic potentialities of gonadal and adrenal steroids often produce undesirable as well as desirable effects. Since all of the undesirable effects are predictable they may be prevented or controlled. Representative complications and their treatment will be discussed.

The control of complications in 100 patients pri-

marily treated with corticoids and 50 patients primarily treated with gonadal steroids will be discussed.

Maternal Age and Leukemia in Offspring.

E. V. COWDRY *and* V. SUNTZEFF, *Division of Cancer Research, Washington University School of Medicine, St. Louis, Missouri.*

Law has reported the surprising discovery that a maternal resistance factor operates in the development of leukemia in mice (Cancer Res. Proceedings, *1*, 31-32, 1935). Briefly stated, the older the mother mice the greater is the resistance of the offspring to spontaneous leukemia. To determine whether the same holds for human beings the ages of 263 mothers at the time they gave birth to a child who later became leukemic were tabulated. All types of leukemia were included but by far the majority were lymphocytic.

Young mothers 15 to 19 years of age had fewer children who contracted leukemia than did mothers in the 20 to 30 age group. After mothers reached the age of 40 the frequency of leukemia in their offspring rose very rapidly. In this series, therefore, no evidence was observed for the presence of a maternal leukemia resistance factor. Sixty per cent of the leukemic children were males; whereas in mice having leukemia females predominate.

Heberden's Nodules and Calcium Deficiency.

L. W. CROMWELL, *San Diego, California.*

The purpose of this paper is to draw attention to an observation made on patients with osteoarthritis, namely that there is a positive correlation between long-term calcium deficiency and the development of such osteoarthritic changes as osteophytes and Heberden's nodules.

The paper elaborates on the strong possibility that a prolonged negative calcium balance produces generalized osteoporosis and that the body compensates at areas of stress with deposits of extra calcium. This thought raises the question whether decreased circulation in areas of tissue damage, with resultant relative anoxia, produces a deposition of calcium. Recent nutritional surveys suggest that for positive calcium balance, 0.5 to 1.0 Gm. of calcium has to be ingested every day.

Using this theory that prolonged negative calcium balance produces generalized osteoporosis, patients at the Arthritic Clinic were reviewed regarding long-term ingestion of calcium.

It was observed that the hands of older patients could most usually be used to tell whether their intake of calcium had been in negative balance for many years. Heberden's nodules, and other osteoarthritic changes in their fingers, were much more pronounced in those with low calcium intakes.

I have observed that women who had bilateral oophorectomies at an early age developed osteoarthritic changes at an earlier age than average women, and that Heberden's nodules occur more commonly in certain families.

The survey revealed that siblings on low-calcium intake showed more osteoarthritic changes than those on high calcium intake.

In addition, 500 oldsters were interviewed regarding their dietary habits. Those with marked osteoarthritic changes were found on the whole to suffer from prolonged low calcium-intake.

Other factors that are involved in the osteoarthritic process are protein intake, estrogen and androgen blood-levels, vitamin D intake and certain metabolic and mechanical influences.

E

Plasma Heparin Levels; Relation to Serum Lipids, Lipoproteins, and Atherosclerotic Disease.

H. ENGELBERG, *Cedars of Lebanon Hospital, Los Angeles, California.*

The method of Gibson for the extraction of plasma heparin has been modified and extended. From 5 cc. of normal human plasma we have obtained an extract which can be assayed for heparin by the U.S.P. method for the titration of commercial heparin. This extract has strong antithrombic and metachromatic activity. Repeated assays of pooled plasma have shown a 60 to 70 per cent recovery of injected heparin.

Recent evidence indicates that heparin plays a role in lipoprotein metabolism. Accordingly plasma heparin levels have been measured in both sexes and at various ages together with determinations of serum cholesterol, phospholipid, and the ultracentrifugal determination of lipoproteins. In addition these studies were carried out in a group of patients with previous myocardial infarctions and in matched controls. All determinations were made in duplicate with the technicians unaware of the previously listed clinical diagnosis.

Results thus far indicate that heparin levels decline with age and are higher in women during a part of the menstrual cycle than in men of the same age. In general plasma heparin correlates fairly well inversely with serum lipoproteins of the Sf 12-20 class, less well with total cholesterol. Analysis of 50 patients with old myocardial infarction and 50 matched normal controls reveals that the majority of the latter fall in a higher heparin level bracket than the majority of the atherosclerotic patients. These findings provide the first evidence suggesting that heparin deficiency plays a role in fat metabolic defects related to atherosclerosis, perhaps similar to insulin deficiency in diabetes mellitus.

F

Aging: A Cross-Sectional Survey and Action Program.

D. FANSHEL, B. KUTNER, *and* T. LANGNER, *Cornell University, Ithaca, New York.*

Five hundred of an estimated 38,000 persons over the age of 60 were surveyed in the Kips Bay-Yorkville Health District of New York City. Selected by systematic sampling procedures, they were interviewed regarding varied aspects of their life circumstances, the state of their health, and their attitudes toward various kinds of public and voluntary health and welfare resources. They were also queried about the problems which they saw as most pressing and the kinds of programs most congenial to their needs and outlook. Relatives and friends of these respondents were also interviewed to gain information about the impact of the problems of the aged upon those close to them and also to gain corroborative information. Selected results indicate that social and recreational opportunities are outstanding as unmet needs. Additional findings will be detailed.

On the basis of both field surveys and an examination of existing facilities for those aged who continue to live in the community, a design for a pilot service program was developed. Plans are under way for an evaluation and referral center to be located at the Health Center in the Yorkville District. The center will have facilities for a health and social assessment of each older person and will be prepared to refer those in need of therapeutic and social service help to the resources in the community best suited to meet their particular problems. Agreement to participate in this program has been obtained from a network of voluntary and municipal hospitals as well as from social agencies in the area. Continued research will be conducted regarding factors which enable or inhibit older persons in the use of existing health and welfare facilities.

Relation of Home Care to Living Arrangements.

MARTA FRAENKEL, *Department of Hospitals, New York, New York.*

Among the aged people afflicted with illnesses requiring long-term care are many who may—for extended periods of time—well be taken care of by an organized home care service if the living conditions are adequate. The home care program of the New York City Department of Hospitals has been serving continuously nearly 1,000 aged persons with chronic diseases on such a home care program.

Social and Psychologic Problems of Old Age.

ELSE FRENKEL-BRUNSWIK, *Institute of Industrial Relations, University of California, Berkeley, California.*

Data on social-political outlook, personality structure, and perceptual and cognitive performance are being collected in industrial workers over 55 years old, some of them still active and others retired.

An intensive interview covers social attitudes, self-perception, experience of aging, subjective meaning of work and retirement, family relations, social activities and friendships, and values in general. Particularly stressed are the problem of the intensification of the authoritarian syndrome with advancing age and that of social realism vs. susceptibility to demagoguery.

Tests patterned after psychologic experiments dealing with picture completion, color vs. form dominance, abstraction, spatial organization, memory, multiple functioning, substitution, and so forth, explore flexibility, ability to restructure the cognitive field, ease of shifting between sets, handling of simultaneous tasks, speed of performance, tolerance for monotonous tasks and routine, precision, and the stability of performance.

Still other tests borrowed from the psychologic laboratory, such as apparent movement (phi-phenomenon), kinesthetic aftereffect, and flicker-fusion rate deal with the suspected reduction of physiologic conductivity and of the speed of recovery from past stimulation in the aging person.

Preliminary results including some reference to case studies will be presented.

G

Lung Compensation and Failure.

B. E. GOODRICH *and* E. E. SCHUMACHER, JR., *Cardiorespiratory Division, Henry Ford Hospital, Detroit, Michigan.*

The study, a presentation of pulmonary changes resulting from age and disease, reports symptoms, physical findings, evidences of structural changes and measurements of functional capacity on slides in outline form. Evidences of declining capacity and decreasing reserve are represented by cases which classify as follows: (1) emphysema, cases which demonstrate the condition to be compensatory for or the cause of diminished ventilatory capacity; (2) pulmonary fibrosis which is shown to be of exogenous or endogenous origin; (3) pulmonary artery hypertension which is demonstrated to be the initiating cause of chronic lung disease or the result of associated pulmonary abnormalities; (4) pulmonary vascular sclerosis which may ultimately be associated with the conditions above mentioned.

The cases reported give evidence that chronic nontuberculous pulmonary disability results from combinations of emphysema, fibrosis, pulmonary hypertension, and vascular sclerosis. Infection is shown to be of importance in initiating or in stimulating the advance of these compensatory and disabling changes. Extra-pulmonary reflex and structural effects will be discussed. It will be shown that the character of terminal states in patients so handicapped is varied and often misinterpreted.

The value of this report lies in the fact: (1) that antibiotics have prolonged the lives of pulmonary cripples and increased the number of current cases; (2) that prophylactic and symptomatic medical assistance is of greater value than is generally known; (3) that states of impending death may often be effectively managed if the conditions are carefully interpreted.

Changes in Oxygen Consumption and Heart Rate During Growth and Aging in Rats: Role of the Thyroid Gland.

B. GRAD, *with the technical assistance of* L. CAPLAN, *Gerontologic Unit, Allan Memorial Institute, Department of Psychiatry, McGill University, Montreal, Canada.*

The oxygen consumption and heart rate were determined in 27 day old Wistar rats (9 females and 5 males) and repeated at intervals until 250 days of age. The oxygen consumption (cc. per hour per gram$^{3/4}$ of body weight) and the heart rate (beats per minute) decreased as the rats of either sex grew older ($P < 0.001$). Males had a higher oxygen consumption than females ($P < 0.001$), especially in rats between 2 and 7 months old. There was no significant difference in pulse rate due to sex ($P > 0.20$).

In another experiment, the oxygen consumption and heart rate were measured once in each of 176 Sherman rats. Twenty-one were females between 1 and 61 days old, the remainder being males between 1 and 1040 days of age. The lowest values of the oxygen consumption (per gram$^{3/4}$) were found at birth, but they climbed rapidly to the highest values of the whole series in rats 16 days old ($P < 0.001$), after which a decline to a second minimum occurred in rats 21 days old ($0.01 > P > 0.001$). However, the value at the 21 day stage was still higher than that of the newborn rat. From the 21st day on, the oxygen consumption per gram$^{3/4}$ rose to a second maximum at 32 days of age ($P < 0.001$) and declined again thereafter, rapidly until the 76th day ($0.02 > P > 0.01$), and more slowly until the 1040th day ($0.01 > P > 0.001$). The mean and standard error of all the oxygen consumption determinations taken in this experiment was 5.5 ± 0.1 cc. per hour per gram$^{3/4}$ body weight.

The heart rate also started out at its lowest values at birth remaining more or less constant for the first 10 days of life ($P > 0.01$), and suddenly increasing by about 50 per cent between the 11th and 16th day ($P < 0.001$). Thereafter, the changes in heart rate paralled more or less the changes in oxygen consumption per gram$^{3/4}$ body weight. The mean and standard error for the heart rate determinations in this series was 375 ± 7 beats per minute.

In a third experiment, the oxygen consumption and heart rate were measured in a group of 32 male Sherman rats ranging in age from 76 to 1040 days old. Values were obtained before thyroidectomy and about a month afterwards. The percentage fall in the oxygen consumption due to thyroidectomy was less in the older animals than in the younger ones ($0.05 > P > 0.02$), and the same was true of the heart rate ($0.01 > P > 0.001$). This suggests that the thyroid gland was less efficacious in maintaining the oxygen consumption and heart rate of old male rats as compared with young ones.

(This work was supported by a grant from the Federal-Provincial Mental Health Grants.)

Aging and the National Economy.*

E. T. GRETHER, *Institute of Industrial Relations, University of California, Berkeley, California.*

Anticoagulants and the Prevention of Vascular Accidents.

G. C. GRIFFITH, *Department of Medicine, University of Southern California School of Medicine, Los Angeles, California.*

There is no proof that the anticoagulants, heparin or the coumarin derivatives, alter the course of atherosclerosis. The anticoagulants are helpful in preventing thromboembolism following an acute myocardial infarction, thromboembolism associated with congestive heart failure, thrombophlebitis in the older age group following surgery, and the formation of thrombi in main or collateral vessels in certain peripheral vascular diseases. The use of the anticoagulants is fully warranted and not dangerous when controlled by an adequate prothrombin test.

H

Activity Planning for Retirement by Executives.

H. R. HALL, *Consultant on Executive Retirement, Wellesley Hills, Massachusetts; formerly professor of research in business administration, Harvard Graduate School of Business Administration, Boston, Massachusetts.*

"What shall I do after leaving my full-time career job?" We shall consider this question as it applies to reasonably healthy men who have had considerable experience in planning and directing the energies of others.

Adequate answer to that question is usually the most important yet neglected task for an executive in connection with all questions bearing on his retirement planning. Long interviews with more than 500 career-active and retired executives form the basis for this belief.

Roughly, a fifth of executives do not need to be so concerned with activity programming as the other four-fifths.

A very small part of the one-fifth have always been inherently lazy, driven to work by family necessity.

Another small portion, along with their wives, are sufficiently social minded that predominately social activities suffice in retirement.

Others have disliked their jobs for any number of reasons and get a feeling of relief from discontinuance of them.

Finally, some top-management members of sizeable organizations are usually in such demand that their programing is facilitated by requests for their services after retirement.

Guidance suggestions for activity planning are applicable to the four-fifths of executives who should undertake such preparation.

Insufficient money many times dictated the need for employment, part or full time. On the other hand sufficient or plentiful financial means was clearly not of itself the requirement for retirement happiness. In fact discussions led to the studied conclusion that omission of activity programing might well nullify, in whole or in part, the success of individual retirements for which there had been good financial preparation. Moreover, incomplete answers to "What shall I do" many times led to unsatisfactory decisions regarding home location after retirement and to insignificant consideration of what the wife's views were on this important team subject.

The following subjects are briefly discussed as guidance points for executives facing activity preparation for retirement.

1. Guard and nourish your health and get your wife to do likewise.

2. Consult with your wife from the start and during retirement planning.

3. Be sure the costs of retirement living are conservatively within your financial ability to support them. In financial budgeting allow extra money for the first year to permit more gradual cut-back in your standard of living.

4. Plan an active life both mentally and physically but paced to suit your desires and well-being. Flexibility in your activity program is highly desirable.

5. Unless you decide that a full-time job is what you want, include a number of part-time activities, in both work and play. Variety adds to interest and satisfaction.

6. If possible, become a member of some organization team which you respect.

7. Include some work that brings pressure and resulting tension with it. The need for a minimum of tension when he retires remains in the executive's system.

8. Consider carefully, but not exclusively, the field of organization and non-organization interests with which you have had the most experience but only those which you have also enjoyed.

9. If you do not have in your program work resulting from past nonbusiness interests which include some satisfaction from doing for others, determine a new assignment. Do at least one such job wholly without monetary return.

10. Seek in the over-all program at least one new activity, preferably involving suspected skills.

11. If you have a well developed hobby or hobbies, include such activity in your program. Most men find, however, that relying on hobbies alone for retirement time does not bring full satisfaction.

12. It is better to plan too much than not enough. Some margin is advisable for proposals that may not be practical or those that a tryout suggests are not right.

13. Consider as natural the doubts and fears that may arise in connection with your retirement program. Go about eliminating them as you have in the case of other important programs of your earlier life, through the use of good judgment and the power of decision.

14. If you want to take a "long trip" or "deserved and desired rest" at the start of your retirement period, be sure important elements of your activity program are tied down beforehand.

15. When it is time to implement your program do so promptly and enthusiastically. Adopt a positive attitude toward the new and final venture that is designed to round out your life by self-selected opportunities for accomplishment and satisfaction.

The study of executive retirement is, of course, even more in the pioneering stage than is true for the much larger number of non-executive workers. Constructive activity planning by the executive group, however, can bring disproportionate value to society. Changing unhappiness to happiness on the part of this important segment should be a social as well as individual accomplishment. The gerontologic challenge in the field of executive personnel is outstanding.

Attitudes Toward Old People.

BRITOMAR J. HANDLON, *University of California, Berkeley, California.*

Attitudes toward old people of younger people were the subject of intensive open-ended interviews. These interviews then served as the basis for ideas, hunches, and hypotheses about the dimensions of these attitudes toward old people and a pool of items was created. From this a sample of items was drawn and administered to approximately 100 undergraduates between the ages of 18 and 22 years. A cluster analysis was made to determine the empirical dimensions actually present.

The Treatment of Hypertension in the Elderly Patient with l-hydrazinophthalazine.

R. HARRIS *and* J. J. PHELAN, *Ann Lee Home, Albany, New York.*

Twenty-six elderly patients with significant arterial hypertension received varying doses of l-hydrazinophthalazine (Apresoline) for periods up to one year without any serious side effects. Eighteen of the 26 patients showed definite drops in both systolic and diastolic blood pressures. Several patients also showed improvement of their electrocardiographic patterns. Eight patients demonstrated no objective improvement while receiving Apresoline. Subjectively most of these 8 patients whose blood pressure did not improve felt better while receiving this drug.

During the period of this study all patients were hospitalized at the Ann Lee Home. Blood pressures were taken routinely by the same investigator before the patient got out of bed in the morning. Control blood pressures, blood counts, urinanalysis, blood nonprotein nitrogen, electrocardiogram, and six-foot chest roentgenogram were taken routinely before Apresoline was started and periodically thereafter. Placebo therapy was periodically substituted for Apresoline without knowledge of either the patient or examiner.

The patients may be divided into three groups on the basis of their blood pressure response to the ad-

ministration of Apresoline. In the first group of patients the hypertension improved with the use of Apresoline. After several months of Apresoline therapy this improvement was maintained even when the drug was stopped or a placebo substituted. In the second group of patients Apresoline improved the hypertension, but the blood pressure rose when the drug was stopped. In the third group Apresoline produced no significant response on the blood pressure.

These results indicate that the hypertension of the elderly patient is not a fixed quantity despite the presence of arteriosclerosis and that it will respond to l-hydrazinophthalazine. The use of Apresoline in the treatment of hypertension in the aged appears safe and fairly effective.

The Problem of the Prostate.

F. HINMAN, *Atherton, California.*

The anatomy, physiology, and pathology of the prostate will be discussed, particularly as it relates to problems in the field of gerontology. The point will be made that the prostate has both urinary and genital components.

Migration Trends Among Older People.

H. L. HITT, *Institute of Population Research, Louisiana State University, Baton Rouge, Louisiana.*

This paper indicates the part which internal migration has had in bringing about the differential rates of increase among the aged in the 48 states during the past two decades. Specifically, it (1) estimates volume and relative importance of the net movement of elderly persons into and out of each state between 1940 and 1950 and (2) compares the movement between 1940 and 1950 with that between 1930 and 1940 with the aim of ascertaining whether migration among the aged is increasing.

Migration estimates for the two decades are inferred from the comparison of age classifications at successive census dates. Specifically, for each state the number of aged 55 years of age and over at the beginning of the decade is decreased by the national average to determine expected population 65 years of age and over at the end of the decade. The difference between the expected figure and the observed is assumed to approximate the magnitude and to indicate the direction of net migration.

Tentative findings based on preliminary census data indicate that migration between 1940 and 1950 was a potent factor in bringing about the distribution of our elderly population which prevailed at midcentury. Moreover, the evidence strongly suggests that migration is becoming an increasingly important force in redistributing our elderly citizens. Conclusions based on final census figures now available and buttressed by appropriate cartographic illustrations will be presented.

J

A Program to Prepare College Teachers for Retirement.

G. E. JOHNSON, *Vice President and General Counsel, Teachers Insurance and Annuity Association, New York, New York.*

An adequate retirement income is essential but will not guarantee a satisfactory retirement. Other factors of adjustment and training are involved, factors requiring advance preparation. Teachers need to prepare for a career in retirement just as they need to prepare for a teaching career. A college should establish a definite program to aid its teachers in this preparation. This program may be divided into four parts:

(1) Methods of educating teachers: a. by distributing magazines; b. by utilizing library facilities; c. by distributing pamphlets in the field of preventive medicine, nutrition, hobbies, etc.; d. by designing special courses in adult education and encouraging teachers to attend them; e. by establishing two-week summer institutes designed to fit the needs of older teachers and their wives.

(2) Group and individual counseling.

(3) Periodic medical checkups.

(4) Job placement work, both on a local and a national scale.

K

A Public Welfare Agency Experience in Meeting Some of the Needs of Older People Through a Community Recreation Program.

J. KAPLAN, *Hennepin County Welfare Board, Minneapolis, Minnesota.*

The role of a public welfare agency in organizing recreation for older adults is discussed. Its contribution is analyzed in relation to discovering and meeting the personal needs of older people through creating opportunities for counseling for them.

A city-wide survey of the leaders of recreational and social programs has shown that various types of counseling requests have been made. Some can be met by existing facilities and personnel; others can perhaps be met most effectively only through cooperation by industry and labor.

A striking development of the recreational movement shows that at times the program of the group can be geared to the personal needs of its members through a form of what can be termed group counseling. As a concomitant, individual counseling requests may increase or diminish, dependent upon the group environment and the quality of group leadership.

The experience of a public welfare agency, the Hennepin County Welfare Board (Minneapolis area) in Minnesota, suggests that one public welfare agency role is to stimulate the development of recreational facilities with a broad base of participation and interest on the part of the entire community. Experi-

ence indicates that the information on the personal needs of older adults tends to corroborate the public welfare worker's views. A real contribution of this recreational movement will come in generating interest for creating counseling opportunities for the older adult and the refinement of counseling techniques.

Proposal for a Gerontology Building at a World's Fair.

W. E. KEYES, *Florida State Improvement Commission, Tallahassee, Florida.*

Plans are now being made for at least two world's fairs to be held in the Western Hemisphere. This paper discusses the proposed organization and operation of a Gerontology Building which might be included in such a venture as well as the benefits to the field of gerontology that might be expected.

It is suggested that organization of the gerontologic unit be accomplished with the aid of a committee of the Gerontological Society, Inc., representing the various disciplines that would be involved. The present professional classification of the society, biologic sciences, psychologic and social sciences, clinical medicine, and social work and administration, would no doubt prove adequate as the major divisions for exhibits and demonstrations.

Within each major division the program committee would arrange for a unified presentation of exhibits and demonstrations which would show the subject matter, range, and significance of the area. Such specific examples as screening for a variety of diseases associated with advancing age, lectures on nutritional requirements of older persons, demonstrations of handicrafts and other avocational outlets, and exhibits outlining methods of preparation for retirement are mentioned. The effort would be made to organize a program of value to younger as well as older adults.

The Gerontology Building would be operated by a non-profit corporation and would be financed through the sale of space for exhibits and demonstrations to concerns interested in bringing their products before the visitors.

The undertaking should serve the purpose of focusing attention on gerontology as an area of growing importance due to the changing age and institutional structure of our society. It should also provide an effective means of disseminating knowledge gained from research to persons in a position to make use of it.

The Rate of Respiration and Glycolysis by Human and Dog Aortic Tissue.

J. E. KIRK, P. G. EFFERSØE *and* S. P. CHIANG, *Division of Gerontology, Washington University School of Medicine, St. Louis, Missouri.*

The investigation includes measurements performed under aseptic conditions of the respiration and rate of glycolysis by human and dog aortic tissue. The determinations were carried out on cylindrical samples of the aorta, consisting of the intimal and medial coats. The tissue was suspended in a modified Krebs phosphate buffer medium with 0.2 per cent glucose contained in a sterile precision syringe, and the rate of oxygen consumption and carbon dioxide development determined by a modification of the gasometric method of Kirk and From Hansen (J. Biol. Chem., *199*, 675, 1952). The rate of glycolysis was measured both under aerobic and anaerobic conditions; for lactic acid analyses the colorimetric procedure of Barker and Summerson (J. Biol. Chem., *138*, 535, 1941) was used. In some instances the metabolic studies were continued on the same sample at various intervals up to 100 days after death.

The maximal initial Q_{O_2}, $Q^{O_2}{}_g$ and $Q^{a_2}{}_g$ values, measured two to four hours after death were 0.3, 1.0 and 0.9 respectively for the human samples, and 0.6, 1.0 and 1.4 for the dog aortas. The metabolic rates decreased rapidly during the first twelve hours, more slowly later. Both respiration and glycolysis were usually still measurable after two months. The average respiratory quotient was 0.96 for the human samples and 0.93 for the dog aortas.

A calculation of the energy production by the arterial tissue revealed that in the aerobic experiments on human aortas the glycolysis accounted for about 50 per cent, and in the dog aortas for about 36 per cent of the total energy production by the tissue.

(Supported by Grant No. H-891 from the National Heart Institute, Public Health Service.)

L

Age Changes in Body Cells.

A. I. LANSING, *Department of Anatomy, Washington University School of Medicine, St. Louis, Missouri.*

The cytologist instinctively is warm to the comment of Heilbrunn that "In the last analysis, according to any theory, senescence is due to protoplasmic changes, changes which occur in individual cells." The problem is that it is especially difficult to find significant age changes common to most cells. Nucleic acids remain remarkably constant with age, enzymes do not shift significantly, most cell components remain structurally intact. One is led to consider seriously the possibility that age changes in the materials between cells may be important in aging, perhaps more important than changes within cells. Fibrosis of many organs is a common age change.

Pigments which are very insoluble accumulate in nervous tissue, heart muscle, liver, and other organs. The ability of cells to divide is significantly reduced.

Much more study at the cellular level is needed before significant generalizations may be made.

Aging Changes in the Human Sinoatrial Node.

M. Lev, *The Research Laboratories of the Mount Sinai Hospital of Greater Miami, Miami Beach, Florida, and the Department of Pathology, University of Illinois, College of Medicine, Chicago, Illinois.*

The sinoatrial node was studied in all age groups, both grossly and histologically. One hundred and twenty-seven hearts were dissected grossly in the atrial region. The sinoatrial node of 53 hearts were cut in a special manner (described elsewhere) and studied histologically by the following stains: Hematoxylin-eosin, Weigert's elastic tissue counterstained with van Gieson connective tissue stain, Hortega's reticulum stain, Mallory's phosphotungstic acid hematoxylin, and Gomori's trichrome stains for myofibrils, cross striations, and intercalated discs.

The S-A node was found to be a distinct structure, easily identified histologically. Its differentiating characteristics from birth on are: (1) the diameter of its muscle fibers is less than that of the atrial fibers; (2) the number of myofibrils is less than that of the atrial fibers; (3) the fibers have a tendency to be arranged in a plexiform manner in the head of the node, and about the containing artery; (4) the nuclei of the muscle fibers have a narrower diameter than that of the atrial musculature; (5) the striations are less prominent than that of the atrial musculature; (6) there are no intercalated discs seen; (7) there is a prominent elastic network; (8) the collagen fibers are more numerous than in the atrial musculature; (9) the reticular and glycoprotein components of the framework show a distinctive pattern, and are made up of finer and less stained fibrils.

At birth, the node is a relatively large structure in comparison to the atrium. With advancing age it grows more slowly than the atrium. With advancing age there is a slight increase in the size of the muscle fibers, the number of myofibrils, and the prominence of striations. Likewise there is a moderate increase in collagen up to adulthood and a slight increase thereafter. However, there is a marked proliferation of elastic fibers throughout life. Fat tissue begins to infiltrate the node at about 30, and is very common after 40 years of age.

(This investigation was supported by a grant from The Heart Association of Greater Miami, and by a grant (H-430 C_2) from The National Heart Institute of the National Institutes of Health, United States Public Health Service.)

The Prevention of Heart Disease.

W. H. Lewis, Jr., *New York, New York.*

The most significant age of illness and mortality is after 50 years of age. The most significant mortality period for males in this country is 50 to 65 years of age, when coronary artery and hypertensive diseases prevail. When the differences in the rate and trend of mortality for different age and sex groups are compared in different decennial eras, the toll of coronary artery disease at age 50 to 65 remains unchanged or even increased, while the mortality from other diseases has decreased.

The prevention of heart disease now is primarily the prevention or deferment of the etiologies of arteriosclerosis and hypertension. Only a small segment of this problem can be evaluated.

The more helpful approach at present is to give some perspective to the problem.

Middle-Age and Aging in the Community.

M. B. Loeb, *Kansas City Study of Middle-Age and Aging, Kansas City, Missouri.*

A report on the social and psychologic approaches being used in the Kansas City Study of Middle Age and Aging, which is being conducted by the Committee on Human Development, University of Chicago, will be given.

A Statewide Survey: Situation and Needs of the Aging.

H. H. Lund, *Technical Director, The Governor's Commission to Study Problems of the Aged, Rhode Island and Providence Plantations, Providence, Rhode Island.*

The Governor's Commission to Study Problems of the Aged in Rhode Island and Providence Plantations conducted a survey of the population 65 years of age and over in January, 1953, as a means of obtaining a reliable factual background for its work. The schedule includes sections on household composition and personal characteristics, work experience, source of income, assets and liabilities, housing facilities and cost, adequacy of living arrangements, health status, and medical services, and use of leisure time.

The schedule was prepared in consultation with the U. S. Bureau of the Census. The sample was drawn by the Bureau. All persons 65 and over residing at designated addresses constituted sample persons. Enumerators were engaged, instructed, and supervised in their field work by the Bureau.

Completed schedules after weighting totaled 2,042 and the ratio of this to total population in the age groups surveyed was 1 to 35. Age, sex, marital status, and age distributions were found to correspond closely to those of the 1950 decennial census.

Processing of the schedules and preparation of tables were performed under supervision of the Commission staff and results were embodied in the descriptive section of the report by the Commission published July 1, 1953.

It is believed that this is the most comprehensive statistical survey of the aged population so far conducted on a state-wide basis. It has added unquestionably to the effectiveness of the Commission's work.

M

Problems of Aging in Air Transportation.

R. A. McFARLAND, *Harvard University School of Public Health, Boston, Massachusetts.*

Potentials of an Aging Population—the Connecticut Approach.

W. C. McKAIN, JR., *University of Connecticut, Storrs, Connecticut.*

The Connecticut General Assembly in 1953 authorized the appointment of a Commisson to study the Potentials of an Aging Population. Emphasis was placed on potentials rather than on problems. Recommendations for appropriate administrative or legislative action will be based on the results of research designed to determine the potentials or resources of persons approaching retirement age. The attitudes, expectations, and plans of persons 55 to 64 years of age will be examined with reference to their skills, health, experience, and other resources. This paper outlines the research design and summarizes the findings to date.

Long Range Study of the Use of Broad Spectrum Antibiotic in Elderly People.

L. V. McVAY *and* D. H. SPRUNT, *Institute of Pathology, University of Tennessee, Memphis, Tennessee.*

The health of an elderly individual is frequently impaired by intercurrent infections. These infections might be ones which a younger individual would overcome with ease. In the aged, however, they may lead to a fatal outcome.

With this in mind, we decided to study the effect of a broad spectrum antibiotic, aureomycin, as a prophylactic measure on a number of elderly patients.

For this study 400 ambulatory patients from our Out-Patient Clinic were selected. These fell into 3 main classes—cardiacs, diabetics, and pulmonics. Approximately one-half of these were given a placebo which contained vitamins and minerals, and the other half were given vitamins and minerals plus 500 mg. aureomycin. The two capsules were identical in appearance. Neither the patients nor the physician knew which were on the placebo and which were on the aureomycin.

These patients have been studied with a number of clinical and laboratory tests. The results have been striking. The ones receiving the aureomycin are much better in almost every respect than the controls.

All the patients have been extensively studied from a bacteriologic standpoint and it is quite interesting that no significant increase in bacterial strains resistant to aureomycin has developed. Also, there have been no significant changes in the basic flora of the alimentary tract.

The Personnel Officer in Retirement Preparation.

E. H. MOORE, *Portland State College, Portland, Oregon.*

The personnel officer can wisely function in the following areas of service to the older worker. These are (1) to condition attitudes which can give meaning to living after the paid job or position is relinquished, (2) to expose the worker to acceptable and meaningful roles in later maturity and retirement, (3) to suggest community and other resources available to the older person, (4) to acquaint the worker with developments in community organization which provide for active participation of older citizens, (5) to encourage in each worker a critical evaluation of his own personal resources and potentialities, (6) to challenge the worker in keeping with his own capacities, and (7) to provide a rationale for the changing of habits and attitudes which block the satisfactions that may be enjoyed in later maturity.

Nutritional Aspects in the Aging.

AGNES FAY MORGAN, *University of California, Berkeley, California.*

A nutritional status study was made in 1948-1949 of 577 men and women over 50 years of age, residents of San Mateo County, California. Physical examinations, 7 day dietary records, x-rays of chest and bones, blood analysis for 10 constituents, and qualitative urine tests were made. All data were tabulated and statistically evaluated with special reference to establishment of norms for persons in this age group and correlations of biochemical and dietary data. Certain correlations were found particularly as to hemoglobin and iron and protein intake, serum ascorbic acid and ascorbic acid intake and others.

Results of Low Cholesterol-Low Fat Diet Plus Lipotropes in the Treatment of Atherosclerosis.

L. M. MORRISON, *Department of Internal Medicine, Medical School of the College of Medical Evangelists, Los Angeles, California.*

The studies investigated the therapeutic results obtained by a lipotropic combination plus a low fat-low cholesterol diet in a series of 40 patients who had proved coronary atherosclerosis as evidenced by previous coronary thrombosis and myocardial infarction. A control series of 40 patients with the same proved disease was employed for comparison over the same length of time, but who were not treated by the lipotropes or diet.

In the treated series of 40 patients there were no deaths or recurrences of coronary thromboses. In the control or non-treated series of 40 patients with myocardial infarctions there were 10 cardiac deaths, a mortality rate similar to three other series of cases at three other comparable institutions.

The biochemical effects of the lipotropic-dietary combination were studied via the serum lipoproteins

in these 40 patients. The total serum cholesterol levels were effectively reduced and the serum phospholipid levels effectively elevated. Abnormal low phospholipid cholesterol ratios prior to treatment were converted to normal PL/C ratios following treatment, indicating an arrest or regression of the atherosclerotic process in the coronary arteries of the treated patients.

Clinical improvement in the series of 40 treated cases was manifested by reduction or abolition of anginal pain, dyspnea, and associated cardiac symptoms. A number of previously disabled patients were enabled to return to normal activities following treatment, concomitant with increase in well-being and strength.

The lipotropic combination was also studied in other diseases such as essential hypertension, cirrhosis of the liver, diabetes mellitus.

The Place of an Old Age Home in the Community.

ANNA S. MYERS, *Charles C. Knox Home, Wynnewood, Pennsylvania.*

It is important that homes for the aged take an active part in the religious, social, and civic life of the community. The residents of the home gain the joy of service, the satisfaction of being needed, and a better understanding and acceptance of current trends. The community benefits from the utilization of the wisdom, experience, and sympathy of its older citizens.

N

National Committee on the Aging of the National Social Welfare Assembly. 1790 Broadway, New York, New York.

The National Committee on the Aging of the National Social Welfare Assembly will have an all-day meeting on August 28, immediately following the meeting of the Gerontological Society, Inc. All meetings will be held at the Hotel Mark Hopkins.

The luncheon and afternoon sessions will be open to all interested persons and members of the Gerontological Society are cordially invited to attend. The luncheon meeting will be entitled, "In the Vanguard of Service Programs for Older People on the West Coast." In this session there will be reported a group of significant programs in actual operation in various fields such as public information, housing, retirement, and creative activities. The afternoon meeting will be devoted to the subject of sheltered care. It will be based on the needs of older people for various kinds of institutional care in relation to the findings and recommendations of the special committee on standards for sheltered care. The recent publications of this committee will be used as background material for the discussions. These publications are entitled: Standards of Care for Older People in Institutions, Section I—Suggested Standards for Homes for the Aged and Nursing Homes, and Section II—Methods of Establishing and Maintaining Standards in Homes for the Aged and Nursing Homes.

The morning sessions will be devoted to a meeting of the West Coast advisory committee to the project on Criteria for the Continued Employment of Older Workers, and a business session devoted to activities and plans of the National Committee on the Aging. Attendance at the morning meetings will be limited to members of the Committee and their invited guests.

O

Non-Institutional Living Arrangements.*

M. J. OSTOMEL, *Welfare Council, Los Angeles, California.*

Age and Mental Abilities—a Longitudinal Study.

W. A. OWENS, *Iowa State College, Ames, Iowa.*

Problems—To determine the effects of a thirty year age increment upon: (1) the 8 sub-test functions of Army Alpha and (2) the relative magnitudes of individual differences and trait differences; (3) to determine also some of the personal-social correlates of the observed age-ability shifts.

Methods—This study involved the retesting during 1950 of 127 males who had originally taken Army Alpha as freshmen at Iowa State during 1919. All scores were recorded as normalized standard scores from distributions for 1000 comparable subjects, and each person retested also completed a Personal Information Sheet.

Assuming the usual tests of significance, shifts in sub-test functions were estimated from the standard score separations of test and retest means on the norms. Changes in the magnitudes of individual differences were appraised by comparing initial and final standard deviations, and an estimate of the magnitude of any shift in trait differences was secured by subtracting an initial from a final standard deviation of the sub-test scores of each subject. Finally, difference scores were computed (1950 minus 1919) for each sub-test and the total score, and these were classified by item response for each item on the Personal Information Sheet with a view to obtaining the personal-social correlates of the observed age-ability shifts.

Results—(1) Scores on 4 of the 8 sub-tests increased substantially; (2) Individual differences increased slightly and trait differences remained constant; (3) Prominent personal-social correlates of age-ability shifts were education, residence, migration, hobbies and recreations, and income.

P

Susceptibility to Infection During Life Span.

I. A. PARFENTJEV, *Department of Microbiology, Yale University School of Medicine, New Haven, Connecticut.*

Lack of immunity in the young is manifested by the great susceptibility of children to certain diseases caused by parasitic bacteria such as diphtheria and the streptococci and even finds a counterpart in birds as evidenced by epidemics in young chicks. When the antithesis to these common observations is noted it would seem worth reporting.

In working with certain gram negative bacteria, we found that old mice are less resistant than the young animals. Certain experiments performed in this laboratory suggested that it might be due to development during life of a hypersensitivity to saprophytic bacteria (existing in the intestinal tract). This hypersensitivity is not specific, however, since many gram negative bacteria have a common antigen (Parfentjev, 1947). Specifically, we have found that old mice are many times more susceptible than the young animals to *Proteus, Pasteurella, Brucella,* and several other gram negative bacteria. The number of bacteria required to produce infection and death in old mice is far less than the number needed for comparable results in young animals. Similarly, we were able to demonstrate by active sensitization of mice with *Pertussis* vaccine that the resulting hypersensitivity weakened the defense mechanism against invasion by a number of gram negative bacteria, save the homologous organism. This may indicate that, while immunity is species specific, hypersensitivity may cross among the several species. It is evident that for several species of bacteria fewer live organisms are required to kill old and sensitized mice when compared to the young animals.

In association with these studies it is noteworthy that attempts to sensitize mice showed that injection of *Pertussis* vaccine produced hypersensitivity more easily in old mice than in the young (the technique of sensitization was described by Parfentjev, 1947).

The data presented would seem to indicate that this study of the development of hypersensitivity to gram negative bacteria during the normal life span might be fruitful if extended to the problem of aging in humans in relation to certain increased susceptibilities that are found among the aged.

(This investigation was supported, in part, by a grant from the National Cancer Institute, of the National Institutes of Health, Public Health Service.)

Combined Steroid and Nutritional Therapy in Geriatric Rehabilitation.

R. M. PERLMAN, *Institute of Endocrinology and Gerontology, San Francisco, California.*

Aging, at any phase of its occurrence, reflects a sum total expression of biologic resistance to internal and external environmental stress (-ors, -es). Clinical disease represents apparent manifestations of relative adaptation, lack of adaptation, or maladaptation of the living organism whose *milieu intérieur,* in continuous flux, interminably exhibits changing organic expressions of functional adaptations to intrinsic and extrinsic environmental alterations.

Traditional therapeutic approaches, directing attentions to gross, superficial, morphologic aspects of disease in aging, are antiquated. Dynamic therapy based on the detection and eradication of sub-clinical, not yet grossly apparent pathologies—principally physiologic disturbances—emphasizes consideration of the organism in toto. The use of a therapeutic agent containing mixed steroid hormonal and nutritional therapy (*Mediatric,* Ayerst), alone or in combination with other preparations possessing known ingredients with well-defined actions and uses, constitutes relatively modern, positive, vigorous "radical" intervention designed to bolster biologic resistance to disease, thus permitting the achievement of successful therapeutics, reconstruction, and prophylaxis in the Stress Syndrome of Aging. Objective data will be presented in support of this view.

R

The Educaion of the Aging in Institutions of Higher Learning.

W. H. REALS, *Dean, University College, Washington University, St. Louis, Missouri.*

At the Second International Gerontological Congress at St. Louis two years ago, I read a paper on "The Place of the University in the Education of the Aging," in which I said that universities have done very little in serving the educational needs of older persons, although they were doing much for the younger and middle-aged adults. There has been, however, a relatively small number of persons of advanced age who have attended regular adult programs.

At that time, five areas of appropriate service were pointed out: (1) counseling; (2) special courses for older adults as part of the regular extension and adult evening programs; (3) special programs in the field of liberal arts; (4) programs in arts and crafts; (5) admission of older adults to regular daytime classes.

The present paper is based, first of all, upon a questionnaire study directed to the 94 members of the Association of University Evening Colleges, 58 members of the National University Extension Association, and 21 members of the Association of Urban Universities not members of either of the other two groups. These were selected because they comprised almost all of the large urban universities and because extension divisions and evening colleges would perhaps have the greatest number of programs for the

older population. The study also attempts to discover the institutions employing professors emeriti and for that purpose, a number of letters were sent to foundations and individual institutions.

Five institutions provide special courses for adults; 1, only, provides a correspondence course, 17 provide institutes or special short programs, and 24 employ professors emeriti.

Two institutions give tuition free to those 65 or over. A number of others have given this arrangement serious consideration.

Many of those not giving any attention to the problems of the older adult have indicated that they are planning programs, either special courses or institutes.

Medical Management of Nocturia.

P. B. Roen, *Los Angeles, California.*

Medical management of nocturia is carried out only in the absence of organic pathology. Often an urologic examination is necessary to rule out pathology which, if present, becomes an urologic problem.

Nocturia in the elderly patient affects both sexes but from different causes. However, there are certain conditions which are common to both sexes. Usually in nocturia there is more than one cause acting in conjunction with each other as is usual in chronic diseases in adults past mid life. Many times the contributing factors are more productive to frequency at night than the basic underlying pathology. These must be evaluated and gratifying results are obtained from properly directed treatment.

Simple facts are frequently brought out in a thorough history and physical examination which when corrected give relief. The general constitution of the patient, sleep habits, tensions, emotional stability, daily routine, type of work, etc., all have to be taken into consideration. The daily habits of most women are conducive to low grade infections which in turn cause nocturia. Each case is different, requiring individual consideration to obtain results. The cause of nocturia may be found far from the genito-urinary tract.

This disturbing symptom in certain patients may be a big factor in the cause of his ill health and its correction can be a great help in the restoration of his well being. Note should always be made of the symptom, nocturia, its cause ascertained and treatment instituted.

Induction of Tumors in Senile Guinea Pigs.

J. B. Rogers, *Department of Anatomy, and* R. C. Taylor, *Department of Patholoy, University of Louisville School of Medicine, Louisville, Kentucky.*

Senile guinea pigs (those which have survived more than 1095 days, or three years) from families in which spontaneous tumor had been observed were treated with methylcholanthrene in sesame oil injected subcutaneously in the left subcostal region. The descendents of a female ancestor are grouped as a family. Spontaneous tumors have been found only in animals which have survived more than three years. About 10 per cent of the senile animals show a new growth of some type.

The diet, consisting of alfalfa hay, pellets, salt and water at all times, and fresh cabbage two times a week, has been relatively constant since 1941 for all animals in the colony.

The amounts of methylcholanthrene injected varied from 2 mg. in 1 cc. of sesame oil, repeated once after a 30 day interval, to 10 mg. in 1 cc. sesame oil, repeated twice at 15 day intervals.

Young animals, in the first year of life, received the same dosages for comparison. The induced tumors have been sarcomas.

Senile animals developed palpable tumors 49 days (average) after the last treatment with 2 mg. methylcholanthrene; young animals 189 days (average). Senile animals developed palpable tumors 59 days (average) after the last treatment with 10 mg. methylcholanthrene; young animals 128 days (average) after the last treatment.

(Aided by a grant from the U. S. Public Health Service and by a grant to the University of Louisville from the Kentucky State Medical Research Commission.)

Skeletal Anomalies in the Mouse as Influenced by Parental Age.

M. N. Runner, *Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine.*

Parental age has been known to influence offspring in many respects. It is perhaps not so well known that parental age may regularly have a permanent effect on morphology. Male offspring from strain 129 were sampled from parents early and late in reproductive life. It was found that associated with old parents was (a) reduced incidence of cervical rib, (b) increased incidence of lumbar abnormalities (mostly ankyloses), and (c) increased incidence of incorporation of the last lumbar vertebra into the sacroiliac joint.

The preliminary observations were obtained from parents that were sibs and hence of the same age. Distinction between maternal and parental influence was impossible.

Since mice of strain 129 are sufficiently inbred so that all individuals are hereditarily similar, breeding experiments were devised to test for polymorphic influences other than genetic segregation.

Appropriate matings have demonstrated that the parental age effect was primarily matroclinous. Experiments currently in progress will indicate whether or not the parental age effect is cumulative into successive generations.

S

The Saint Louis Program.

A. SALAMONE, *Director of Adult Education, Saint Louis University, St. Louis, Missouri.*

The Saint Louis University program is based on the thesis that the later years can be a period of expansion of interests. It has undertaken to offer preparation for meeting the problems of the later years, counseling, suggestions for retirement activity, and procedures that can be used by personnel officers with employees under their supervision.

The program includes a course of lectures and discussions for older people and another for personnel workers, a weekly radio program, and the organization of activity programs in the Catholic Churches of the city and in park centers.

Successful Administrative Techniques in a Geriatric Unit Associated with a General Hospital.*

K. K. SHERWOOD *and* E. S. BENNETT, *Kings County Hospital, Seattle, Washington.*

Age Change in Body Water and Its Relationship to Basal Oxygen Consumption in Males.

N. W. SHOCK, M. J. YIENGST *and* D. M. WATKIN, *National Heart Institute, National Institutes of Health, Bethesda, and the Baltimore City Hospitals, Baltimore, Maryland.*

Estimates of plasma volume, thiocyanate space, and total body water were made in 94 normal males between the ages of 19 and 95 years. All subjects were tested in the morning under resting conditions by giving a single intravenous injection containing .025 Gm. Evans Blue (T-1824 dye), 1.396 Gm. sodium thiocyanate, and 1.0 Gm. antipyrine. Blood samples were drawn at 0.5, 1, 2, 3, 5, and 7 hours following the injection for chemical analysis. In 41 of the subjects, the determinations were repeated at an interval of 1 to 4 weeks. Fluid volumes were estimated by a least squares fit applied to plots of log concentrations in the blood against time. The mean day to day variance was 1.29 L. for antipyrine space, 0.300 L. for thiocyanate space, and 0.120 L. for plasma volume. Basal oxygen consumption was estimated on two other days by the Tissot open circuit method.

The plasma volume (mean values for decades 2.98-3.10 L.) and thiocyanate space (mean values for decades 16.1-17.0 L.) did not change progressively with increasing age. However, the total body water, as measured by antipyrine space diminished significantly with increasing age (34.5 L. at age 19-39 to 29.7 L. at 80-95 years). Basal oxygen consumption per unit of total body water, or per unit of "intracellular" fluid (antipyrine space minus thiocyanate space) did not diminish with increasing age. Oxygen consumption per liter of extracellular fluid (thiocyanate space) diminished with increasing age as did oxygen consumption per unit of surface area or body weight. It is suggested that "intracellular" water is a valid index of the amount of functioning protoplasma present in the aging body. If this is accepted, the evidence presented indicates a constant average rate of basal oxygen uptake of the tissues after maturity.

Inadequacy of Clinical Diagnosis in Psychoses Associated with Old Age.

A. SIMON *and* N. MALAMUD, *The Langley Porter Clinic and the Department of Psychiatry, San Francisco, California.*

Clinical diagnosis in the psychoses associated with old age is often inaccurate and arbitrary. Such stereotyped designations as senility and arteriosclerosis are frequently at variance with the patho-anatomic findings. No attempt is made to distinguish between reversible and irreversible reactions.

This study is based on an analysis of a series of such cases that have come to autopsy for the purpose of outlining the patho-anatomic findings, correlating the clinical data with the latter and formulating whatever clinical aids in diagnosis the material may offer.

Receipts Status of the Aged; 1951.

P. O. STEINER, *Institute of Industrial Relations, University of California, Berkeley, California.*

The paper presents certain of the significant findings from the special survey of persons 65 and over conducted in April, 1952, by the Institute of Industrial Relations in cooperation with the Bureau of the Census. This sample is a high quality national sample that has provided significant information as to, among other things, the size and sources of receipts of persons and couples in the aged group. Due attention is given to a variety of relevant socio-economic characteristics such as family status, size and type of residence, marital and sex status, and so on. These results and their significance are discussed within limits of the time available.

T

Respiration and Starvation in Relation to Aging in Root Tissue.

F. W. THOMAE, JR. *and* HILDA F. ROSENE, *Department of Zoology, University of Texas, Austin, Texas.*

Actively growing onion *(Allium cepa)* roots without lateral branches provide excellent material for the study of phenomena associated with aging. Their axially distributed tissues, which are comparable in structure and function, show progressive variation in age. Young differentiated tissue is present near the distal end of the root while older tissue is nearer the bulb. Experimental results with the Warburg

technique showed that the younger tissue had a higher rate of oxygen uptake.

A comparison of the effect of glucose on younger and older tissues following varying periods of starvation demonstrated that (a) the length of time the tissues were starved in distilled water was the main factor governing rates of oxygen consumption, (b) younger tissues exhibited a greater increase in Q_{O_2} upon the addition of glucose than did older tissues of the same roots subsequent to short periods of starvation, and (c) the older tissues maintained to a greater degree their ability to utilize substrate after relatively long periods of starvation. The study also included analyses for protein nitrogen on starved and unstarved tissues.

W

Physical Profile of an Aged Group: Data on the First One Hundred Admissions to a New Home for Elderly Women.

A. WAGNER, *The Mather Home, Evanston, Illinois.*

Early in 1952 the Mather Home for aged women, a new institution in Evanston, Illinois, began in an orderly fashion to admit selected women in the age group 65 to 85 years. The physical requirements for admission were condensed into a single precept; that the candidate have a reasonable expectancy of ambulatory self-sufficient existence for at least five years at the time of admission. The regulated admission rate combined with adequate medical facilities in the Home made it possible for the staff, under the supervision of the Northwestern University Medical School, to compile very complete data on every individual in several important physical and laboratory areas. The results of these studies, tabulated for presentation in this paper, demonstrate what may be expected of any carefully selected body of women in this age group when the standard is as given above. The principal physical defects that survived encounter with the admitting criterion and entered the Home uncorrected are illuminated.

The medical experience of the first year of operation is detailed with emphasis upon the needs that became apparent and the measures that were taken to meet them. The more important among the services rendered are treated briefly in terms of utility versus cost.

Policies of Admission and Finance in Homes for the Aged.

B. R. WALL, *The Methodist Home, Charlotte, North Carolina.*

Respect for the personal rights of the residents of a Home for the Aged is the primary secret of their happiness and well-being. Respect for the resident begins before admission, which should always be by voluntary application.

The study covers 44 church Homes. Of their total population 42.2 per cent receive charitable supplements from the Home or the sponsoring religious organization. Only 17.8 receive Old Age Assistance grants. Five of the 44 Homes have no residents who receive these grants. All Homes report that it is necessary to supplement these grants in order to provide a suitable standard of living.

Residents with limited resources usually pay, or have paid for them, a minimum subsidized rate, which averages $1,066.00 per annum. This is paid monthly or by advance deposit in reserves for care.

Residents with more ample resources are expected to pay the full cost of their care, including a fair amortization of the capital investment.

The Homes differ in their policies regarding economic resources in excess of the cost of care. Some require all of the resident's resources. Some operate on an individual case work policy commonly known as "merits of the case."

Only 41 per cent of the Homes which require a resident to transfer all of his resources are expanding their facilities, while 86 per cent of the Homes operating on the "merits of the case" are building additional facilities. The "merits of the case" Homes provide charity supplements for 34.6 per cent of their population. While they attract people with more ample resources, they do not neglect those in economic need. Admissions policies have a decided influence on the financial participation of the resident in the building and operation of the Home.

The funds of the Home should be invested according to the purpose for which they are intended. Fiscal agency accounts with strong banks and trust companies are recommended.

Life income contracts, which pay to the resident the income earned on the financial resources which they have transferred to the Home, are deemed just, safe, and wise from an administrative standpoint.

Occupational Therapy in the Aging.

G. J. WAYNE, *Los Angeles, California.*

Loss of sustaining interests and work habits at a time when the aging individual is adjusting to waning physical and mental powers delivers a staggering blow to his integrity. In addition to the peculiar problems of aging persons in our culture, old neurotic conflicts are rekindled at this time. Resulting trauma to the personality can be assuaged and in some measure negated by intelligent prescription of occupational therapy tailored to the needs and interests of the individual elderly patient.

In compounding the prescription, the psychiatrist takes into account (1) the specific character traits of the aged person; (2) the patient's neurotic conflicts, together with his unconscious methods of handling these conflicts; and (3) the specific environmental traumata which have precipitated the emotional crisis. Specific occupational therapy measures will be dis-

cussed in this paper, which will include an assessment of the values of various types of specific therapy considered from the psychodynamic viewpoint, and will discuss their adaptation to meet the needs of the individual patient.

Special Services for the Senile in a Home for the Aged.*

J. WEIL, *Montefiore Home, Cleveland Heights, Ohio.*

Exogenous Lipids and Mucopolysaccharides as Factors in Experimental Arteriosclerosis.

C. A. WOERNER, *Department of Anatomy, University of Louisville, Louisville, Kentucky.*

To determine the role of exogenous lipids and mucopolysaccharides, a series of emulsions were injected intravenously into guinea pigs and rabbits. The lipids included olive oil, cholesterol, cholesterol palmitate lanolin, and beef spinal cord lipids. Bovine vitreous humour was used as a source of mucopolysaccharide. Emulsions were prepared with a high pressure homogenizer to produce droplets of less than 1.0 μ, others with droplets approaching 10.0 μ.

In none of the animals injected with triglycerides was any lipid found in the walls of the aorta or coronary arteries. With very large amounts of egg yolk there was a small amount of lipid deposition. Cholesterol or cholesterol palmitate did not deposit in the arterial wall when as much as 2.0 Gm. per kilo was injected as a colloidal solution in 48 hours.

When as much as 20 Gm. of bovine vitreous humour was injected intravenously and the arteries, liver, and spleen were studied by the method of Rinehart, none was found in the arterial walls, a little was seen in the Kupffer cells of the liver, somewhat more was demonstrated in the macrophages of the spleen.

The failure of these exogenous lipids and mucopolysaccharides to deposit in the arterial wall may indicate that the lipids and mucopolysaccharides found in arteriosclerotic vessels comes from degenerative changes in the cells of the arterial wall, rather than the deposition by phagocytosis of exogenous lipid, or mucopolysaccharide.

(Aided by a Grant from the National Heart Institute (H-180).)

BOOK REVIEWS

RETIREMENT AND THE INDUSTRIAL WORKER — PERSPECTIVE AND REALITY, by Jacob Tuckman and Irving Lorge, Bureau of Publications, Teachers College, Columbia Universtiy, New York, 1953, 105 pages, $2.75.

This is a book packed down and running over with a full measure of facts gleaned from an impeccable study (by the Institute of Adult Education, Teachers College, Columbia University) of a sample of workers in the garment industry—sponsored, under the auspices, and with cooperation of the International Ladies' Garment Workers Union, through its New York Cloak Joint Board. The sample included 2 per cent (300 workers) of those on the job, 10 per cent (140) of those who had applied for retirement, and 5 per cent (125) of those in retirement.

The study is particularly interesting in view of the current claim that retirement and social security in general deter workers from continuing work. The industry is "old" in its personnel: 63 per cent are over 56 years of age, 32 per cent over 60, 13 per cent over 65, and 4 per cent over 70. Most of the sample did not want to retire at age 65—those responding this way included 70 per cent of those on the job, 65 per cent of those who had applied for retirement, and 69 per cent of those who were in retirement. (This fact is verified in other industries; for example, U.S. Steel found that only 40 per cent of its retired workers stopped work when eligible for retirement; General Motors found less than 10 per cent stopped work at that time, and Chrysler, 11 per cent.)

In the garment industry, the reasons for "attitude toward retirement" bunched up under "poor health," "a desire to rest," "and no longer able to work." A surprising number were not looking forward to retirement but saw it as a necessity.

The group studied is by and large composed of the most skilled of the industry, that is, those who make the whole garment rather than just sections or pieces. (In the industry as a whole, 40 per cent do "section" work, but in the sample only 20 per cent do so. It is to be observed that the "whole" garment work requires "skill and creativity" compared to the routine of "section" work.) The lives of these workers are devoted to the industry and built around the union. In slack times, when they are out of work, most of them leave home as if to go to work and spend their days around the market. When friends meet, they inquire first of the job and shop and general conditions of the shop, and only then about family and friends. In light of this, it is ironically significant that the general wish of parents is to help children toward higher level positions, with the result that many children are found in professions, or in executive jobs.

Only about one-half of the sample like the idea of retirement, want to retire, or look forward to it—rather more women than men among this half. Among those who had retired, health in the main improved or stayed the same; only 18 per cent found their health becoming poorer—though these reports could partly be a psychologic reaction to loss of the job. (An illustration of the fascinating lines of inquiry in this book is found in the fact that those who had been on "section" work were not as unhappy on giving it up as those on the tailor system, working on the whole garment.) Of the women whose health became worse, 20 per cent reported "no friends."

There is a good deal of feeling among the older workers that the former cooperative spirit between the older and the younger worker has declined markedly, the latter being "concerned entirely with his own security and achievement." There seems to be no generalization to be made supporting a decline in productivity with age. It depends on the individual worker. Some workers over 70, on a piece work basis, have averaged over $5,000 a year for the last five years. One man at age 77, unable to work a good deal of the time because of illness, has averaged $1,800 a year for the last five years.

Almost all the sample thought that the union should have a center where the aged workers could play cards, meet friends, and "chew the fat," more men than women being of this view, which puts a lot of men in their place. Most of the respondents thought that their social security benefits and pension amount was too little to live on. Wives and husbands do not always agree about retirement. A 71 year old applicant is not looking forward to retirement, but his wife is, because then she will not have to worry about him. A 55 year old man looks forward eagerly to retirement, but his wife thinks he ought to be able to work until 75 and considers him, as well as other men, a "sissy. They sit and they nag and they talk themselves sick." On the other hand, there is constructive agreement among a third to a half of the couples, depending on their status with respect to retirement or job.

These are samples of pertinent and salty human facts drawn out of a study that is rich in similar and even more significant data. Among the conclusions and recommendations is one that reflects the very low status of old-age in a society that puts a premium on youth and economic self-sufficiency and depreciates older age as lacking the competing qualities. The force of declining health in retirement suggests more attention by employers to maintenance of worker health. Because only 20 per cent of the respondents thought that they would have enough to live on, it is necessary that workers be helped to plan living on a reduced income. Reassessment of retirement bene-

fits is needed. A suggestion is also made that tax exemptions might be given for systematic savings set aside for retirement. One of the most interesting of the recommendations centers on a continued relationship with the job or union setting, based on the fact that the worker is anxious to maintain an identification with the years of his productivity.

All in all, this slim volume is full of clear and thoughtful facts, worth a lot of chewing.

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A SOCIAL PROGRAM FOR OLDER PEOPLE, by Jerome Kaplan, University of Minnesota Press, Minneapolis, 1953, 158 pages, $3.00.

This book reports the fruits of a skilled group worker's project to provide a social program for the older adult, a subject hardly touched as yet by community action. "Membership in a group is . . . primarily means for older people to remain contributing members of the community," says Mr. Kaplan, who relies heavily on social science's carefree generalizations for this generality. He also finds qualified support in a fragmented quotation from G. B. Shaw, who was no celebrated group member in the group worker's sense. Nevertheless, the author seems to be correct in his contention: Man *is* a social animal.

Mr. Kaplan knows the evidence for the mental health protections through group activity for the aged in New York, Minneapolis, Philadelphia, and in many less ambitious projects. For example, not a single commitment to a mental hospital was made from the group membership during the five year period in New York, the two year period in Minneapolis, (3,000 members), or from Philadelphia's 89 groups. The results, says the author, are worth the extention of the effort, an extension that could be, should be, under the auspices of a public welfare agency in order to make this social protection more accessible.

From this spring board, he described the work of the Hennepin County Welfare Board (Minneapolis) from 1950 through two years. The program grew to 3,000 members, all over the city, in 35 clubs. Once the sponsor got it going, with a small expenditure, the cost was self-borne. The sponsor's cost was mostly that of a group-worker consultant—Mr. Kaplan stating that whenever a group got too large, effort was made to find interest groups within it to permit the advantages of the smaller group.

The testimony of results is striking—need for medical care dropped, elderly people began to take interest, bloom, and get out to make friends, perk up with new interests. They turned their attention outward. These "senior adults," as Mr. Kaplan calls them with no impression that he is being euphemistic, showed an interest in summer camping, 300 in 1952. An 84 year old, to whom clinic appointments had become the chief interest of her life, forgot her appointment in the camp friends she made.

The pages go on covering a large variety of the recreational outlets in homes for the aged, for the confined, mass activities, and many individual instances of what a blunt person might call personal reform—habits improved, members took more interest in their appearance, kept cleaner and more combed.

There is a chapter on the use of the social group worker that would be stimulating to members of that lively specialty; and there is an excellent chapter on the volunteer with some good hints on keeping the volunteer in line, and ways of training and supervising for a good performance. The remainder of the book supplies a kind of blue-print on how to organize a group, what to do for program, how to increase participation, and an undiscouraged look at homes for the aged and their role. Mr. Kaplan even touches on the tricky business of camping and "fun in the out-of-doors" for the "senior citizen."

Reading this book, one is convinced that Mr. Kaplan deserved the 1952 Survey Award, which he got for his "imaginative and constructive contribution." Anybody interested in our aging population and the problem that is creeping on us unnoticed will find this book more than a pious declaration of the problems. It shows a community-wide approach at little cost except the tremendous investment of idea and technical skill. One of its best qualities is a pleasant acceptance of the elderly person as a non-problem fellow citizen. There is none of that unpleasant tendency to see the aged population as an incipient social pathology or as an unhappy price of progress. There is not even the usual undertone of personal fear of growing old. Add these qualities together and we have a stimulating contribution to the literature.

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PROCEEDINGS OF THE SECOND INSTITUTE ON AGING, University College, Washington University, St. Louis, April 17-18, 1953, 58 pp., mimeographed, paper bound, $1.00.

This review is based on two somewhat different but closely related perspectives: (1) that of a person in attendance at the institute who was able to witness and sample the general mood and tone of the meetings—or at least of those sessions which he was able to attend; and (2) that of a more detached evaluator who, in the privacy of his study, can read the published proceedings (after editing of course) and, after reflection, reach certain conclusions about the ideologic impact of the institute as a whole.

I am happy to report that in this instance there is no discrepancy between the two impressions. Rather,

the second perspective serves to reinforce the impressions derived from the first: that the Second Institute on Aging held under the auspices of the University College of Washington University in St. Louis, Mo., April 17-18, 1953 was a well-organized conference dealing with one of the most significant issues or social problems on the domestic scene and was well-staffed with key figures in this area of research and service. Washington University is a leading institution in the area of gerontology. Its first institute was a resounding success. The second maintains the same high level.

The general spirit of the gathering was clearly and appealingly stated by Dean Robert A. Moore and Professor Frank L. Wright who enunciated the slogan "let us add life to years as well as years to life." It was a spirit of enlightened optimism based on faith in scientific research, cooperation, and democratic procedures. The need for and possibility of cooperation, especially among experts drawn from the various disciplines and professions, was succintly and cogently expressed by Dean Moore at the opening session when he spoke on "Gerontology as a Multidisciplinary Science." This same spirit of friendly intellectual cooperation in meeting a challenging human problem was everywhere in evidence—in the varied types and backgrounds represented in the audience as well as among the conference leaders; in the participation of a number of selected "senior citizens" who presented their personal observations at the evening general session under the aegis of Dean W. H. Reals; in the hearty and enthusiastic exchange of ideas in the panel discussions of the separate specialized interest groups; and in the informal associations between sessions.

Judging by the representation of community leaders from the St. Louis area and by the emphasis on articulating the efforts of researchers and workers in the more applied or service areas, cooperation is being achieved, at least in the vicinity of Washington University. Successful pioneering leadership and example of this sort should hearten persons attempting to organize similar programs elsewhere.

The contributions of the participating experts or resource persons were all at a superior level. Dean Moore gave a very timely warning against any attempt to develop gerontology as "a separable and distinct area of knowledge and activity." In addition he presented an excellent over-all survey of the special aspects or phases of the practical problem of aging and the aged: retirement, economic impact, physiologic age, sex ratio in the population, mode of life, and medical care.

Mr. Clark Tibbitts in his talk on "Aging: Challenge to America," defined the crux of the problem in psychologic and sociologic terms, as a process of transition to a new social role, one that is not clearly defined in our society and culture, or one about which we have somewhat contradictory and inconsistent expectations. Tibbitts held out considerable optimism, however, for a new conception and definition of the aged harmonious with both biologic and social realities and our ideals of personal dignity, usefulness, and freedom of expression. He did much to focus attention on the problem of voluntary vs. involuntary retirement as it is complicated by our industrial structure and our present system of social security. This theme was central to the special sessions on employment, retirement and security, but also seemed to be important in the thinking of all participants.

In the opinion of this reviewer the paper presented by Professor Milton L. Barron on "Minority Group Characteristics of the Aged in American Society" is particularly outstanding. He was reporting in his capacity as Director of the Nation-Wide Study of Retirement and indicated that considerable evidence was available to support the conclusion that the aged in modern society constitute a quasi-minority group and are in process of becoming a full-fledged minority unless present trends are arrested or reversed. The theoretical framework provided by the concept of a sociologic minority would seem therefore to be a significant one to utilize researchwise. The emphasis of Barron's paper served to rectify what might be regarded as an overly individualistic bias in the paper of Dean Moore, who asserted that "productivity, social responsibility, appreciation of spiritual values, and leadership are in a democracy *only the sum total of the characteristics of the individuals*" (italics reviewer's).

Dr. Wilma Donahue gave the luncheon address on the topic "What Can Education do to Solve the Problem of the Aging?" and served to bring the institute to a fitting and profitable close. She pointed out quite lucidly and vividly the importance of education, especially adult education, to any effort at solving the problems posed by our value-conflicts and research findings as they pertain to the aged—the double-barrelled task of educating the elders themselves and the communities in which they reside. She also indicated how education could contribute to the attack on the special problems of employment, constructive use of leisure time, and professional training of personnel for social service in this problem area. Like the other speakers, Dr. Donahue held out the prospect of a dignified, secure, and enjoyable old age for the future America through research and intelligent social planning.

All in all, the Second Institute on Aging of Washington University was another step forward in the social movement directed at defining a satisfactory role for the aged in American society—it represents a successful endeavor in the area of adult education.

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BOOKS RECEIVED

Books received since April 1, 1953, are acknowledged in the following list. In so far as space permits, some will be selected for review in a later issue.

A Home in the Later Years, by the New York State Association of Councils and Chests, 105 East 22 St., New York, 1953, 29 pages, paper bound, 25¢.

A Social Program for Older People, by Jerome Kaplan, University of Minnesota Press, Minneapolis, 1953, 158 pages, $3.00 (Reviewed in this issue, page 392).

Building America's Health, a Report to the President by the President's Commission on the Health Needs of the Nation.

Vol. 2, America's Health Status, Needs and Resources, 320 pages, $1.25.

Vol. 3, America's Health Status, Needs and Resources, a Statistical Appendix, 299 pages, $1.50.

Vol. 4, Financing a Health Program for America, 363 pages, $1.50. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., paper bound.

Notable Papers on Aging,

1. A Twentieth Century Philosophy for Home for the Aged, by Ollie A. Randall, 6 pages, 20¢.
2. A Foster Home Program for Older Persons, by William Posner, 24 pages, 20¢.
3. Rehabilitation of the Aging, by Murray Ferderber, 10 pages, 20¢.
4. Retirement and Pension Planning from a Labor Viewpoint, by Willard E. Solenberger, 7 pages, 20¢.
5. Religion and the Aging Process, by Seward Hiltner, 8 pages, 20¢.
6. Keeping the Older Person Employed, by Elizabeth Hatch, 8 pages, 20¢.

National Committee on the Aging, National Social Welfare Assembly, Inc., 1790 Broadway, New York.

Proceedings of the Council on High Blood Pressure Research, 1952, American Heart Association, Inc., 44 East 23 Street, New York, 1953, 113 pages, $1.75.

Proceedings of the Second Institute on Aging, Washington University, April 17 and 18, 1953, University College, Washington University, St. Louis, 1953, 58 pages, mimeographed, paper bound, $1.00 (reviewed in this issue, page 392).

Retirement and the Industrial Worker, by Jacob Tuckman and Irving Lorge, Bureau of Publications, Teachers College, Columbia University, New York, 1953, 105 pages, $2.75 (Reviewed in this issue, page 391).

*Retirement Village Planning for Florid*a, the Need for an Engineering Approach, by Richard S. Sahlie, Retirement Research Division, Florida State Improvement Commission, Tallahassee, 1952, 47 pages, paper bound.

Standards of Care for Older People in Institutions, Section 1. Suggested Standards for Homes for the Aged and Nursing Homes, National Committee on the Aging, National Social Welfare Assembly, 1790 Broadway, New York, 1953, 112 pages, paper bound, single copy $1.00, 5 to 25 copies 75¢ each, over 25 copies special rates.

INDEX TO CURRENT PERIODICAL LITERATURE

NATHAN W. SHOCK
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The subject categories are those in *A Classified Bibliography of Gerontology and Geriatrics* by Nathan W. Shock published by Stanford University Press, Stanford, California (1951). Only major headings are used and the Roman numerals correspond to those given in the bibliography. In so far as possible, references are classified according to organ systems. Thus most of the material on Geriatrics will be found under the organ system involved in the disease. Cross references are indicated by number at the end of each section. When available, abstract references are given (*B.A.—Biological Abstracts; P.A.—Psychological Abstracts;* and *P.I.—Population Index*). Abbreviations for journals are those used in *A World List of Scientific Periodicals Published in the years 1900-1933,* 2nd Edition. For journals not listed, abbreviations were devised according to the general rules used in the above source. It is impossible to cover all journals and list all papers concerned with aging and the aged. Authors and publishers are requested to call attention to publications or to send reprints to the Gerontology Section, Baltimore City Hospitals, Baltimore, Maryland. The assistance of the Forest Park Foundation, Peoria, Illinois, in the preparation of these materials is gratefully acknowledged.

GERONTOLOGY

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